

CH 1

CHAPTER 2. Alternatives Including The Proposed Action

INTRODUCTION

To develop water contracting alternatives for the SRSA, ARSA, and DESA EIS's, CVP-wide water allocation alternatives were first developed. The CVP-wide water allocation alternatives consist of alternative allocations of available CVP yield to each of the three major CVP service areas. A set of detailed service area alternatives was then developed for each of the three service areas. The service area alternatives are consistent with the CVP-wide alternatives and allocate water to individual entities within the service area.

This chapter of the EIS first describes the CVP-wide alternatives. The process for development of CVP-wide alternatives, water allocations under each CVP-wide alternative, Reclamation's proposed CVP-wide water allocation, and CVP-wide alternatives eliminated from detailed study are reviewed. The chapter next describes a set of detailed service area alternatives developed to be consistent with the CVP-wide alternatives. The final sections of this chapter present actions needed to implement the alternatives and proposed Reclamation contracting principles and also a summary comparison of the alternatives and their impacts. The alternatives cover a wide range and introduce new contracting concepts (e.g., conjunctive use of surface water and groundwater and dependable and intermittent supplies). Public comments are particularly encouraged on the options and the concepts.

The discussion in this chapter refers to three types of CVP supplies: firm yield, intermittent, and interim. These categories of supply are defined in detail in the "Yield Analysis" section of this chapter. In summary:

- o Firm yield is a term used by Reclamation, DWR, and other agencies in California to denote water that can be made available by project operations using hydrologic data for the 1928 through 1934 dry period and accepting a deficiency of 100 percent of one year's supply during those seven years (not to exceed 25 percent in any one year). Imposing such deficiencies in all critically dry years results in delivery of approximately 90 percent of a contract amount for the 57-year hydrologic period used in analyses for this EIS.
- o Intermittent water is a term used by Reclamation to denote water that can be made available by CVP operations in other than critically dry years, in addition to the firm yield water. The amount available depends on the delivery frequency. Reclamation proposes an intermittent supply that results in delivery of approximately 60 percent of a contract amount for the 57-year hydrologic period used in analyses for this EIS.

- o Interim water is that portion of the CVP firm yield which is not delivered to contractors in any given year. Reclamation enters into interim water contracts on an annual basis if supplies are available.

Reclamation proposes a dependable supply contracting approach for use of CVP intermittent yield water. This proposal calls for use of groundwater or other surface supplies in critically dry and portions of dry and normal years to firm up the intermittent supply delivered in wet and portions of normal and dry years.

CVP-WIDE WATER ALLOCATION ALTERNATIVES

Factors Considered in Developing CVP-Wide Alternatives

The CVP-wide water allocation alternatives were formulated both to achieve Reclamation's water contracting objectives and to reflect concerns expressed in the public scoping process. As described in Chapter 1, Reclamation's water contracting program would, in compliance with applicable state and federal law, meet a combination of the objectives listed below:

- o equitably allocate remaining project yield, considering original congressional legislation, other authorized project functions, and California water rights laws and area of origin policies;
- o optimize the amount of water available considering conjunctive use of surface water and groundwater for agricultural, M&I, and refuge use, and offstream storage at wetland habitat;
- o increase the amount of water available for beneficial uses within California's Central Valley; and
- o optimize economic returns at the local, regional, and national levels.

Other factors considered in formulating the CVP-wide alternatives include the following:

- o Authorized Project Functions. Over the years, Congress authorized features of the CVP to meet the following specific functions: flood control and navigation, irrigation, domestic, and M&I uses, power, fish and wildlife, recreation, and water quality. The alternatives assume continued operation of the CVP to meet these functions.
- o Project Repayment. Reclamation is required by law to obtain repayment of reimbursable costs of the CVP, including applicable interest associated with project capital as required by law.

- o COA Operational Criteria. Existing Delta water quality standards influence the amount of water available for beneficial uses. Reclamation is now in the second year of operating under the COA as authorized by PL 99-546. Section 10(h) of the COA requires Reclamation and DWR to negotiate an agreement to assist each party in making more efficient use of state and federal project facilities and water supplies. As required by PL 99-546, 25 percent of the uncommitted CVP firm yield will be reserved from long-term contracting, until 1 year after the Secretary of the Interior has transmitted to Congress a feasibility report together with his recommendations on the refuge water supply. Alternatives are considered that do not reserve 25 percent of the uncommitted firm yield for refuges to allow evaluation of a complete range of potential contracting actions.
- o Prior Water Rights and Existing Contracts. Reclamation recognizes that water rights senior to federal rights exist along the major rivers. Reclamation has previously determined the volume of water needed to provide for those rights on the Sacramento, American, San Joaquin, Trinity, and Stanislaus Rivers and has provided for that water either through contracts or in project operations. Reclamation also has numerous existing contracts for irrigation, M&I, and refuge water supplies. The CVP yield available for new contracts is over and above the yield previously committed to satisfy prior water rights and existing contracts. (See following section on "Yield Analysis.")
- o Area of Origin. The State of California's County of Origin and Watershed Protection Statutes generally provide certain priorities for the use of water within watersheds and adjacent areas and counties of origin. The Delta Protection Act imposes certain limitations on the export of water from the Delta. The water contracting alternatives accommodate applicable requirements of these laws.
- o Scoping Comments Related to Fish, Wildlife, and Recreation Needs. A number of comments were received during the scoping process on the development of alternatives. The scoping process resulted in the development of certain CVP-wide alternatives that emphasize allocations of remaining CVP yield for fish and wildlife and to recreation. Specific dispositions of scoping comments are described in the Scoping Reports for the SRSA (July 1987), ARSA (September 1987), and DESA (September 1987) Water Contracting EIS's.

Assumptions Regarding New Facilities

The uncommitted CVP yield allocated in the CVP-wide alternatives is that which can be produced by existing CVP dams, reservoirs, and other facilities. Additional yield that could be produced by potential future projects such as Auburn Dam is not considered in the CVP-wide allocation alternatives. However, conjunctive use programs which increase the available water supply through operation of groundwater aquifers are considered in some alternatives. The use of DWR Delta Export pumps (Banks Pumping Plant) to increase the yield which can be delivered to the DESA are also assumed for some alternatives.

Some CVP-wide alternatives assume, however, that certain improvements to specific conveyance systems would be made. These improvements are limited to construction of: 1) a new conveyance facility to serve Yolo and Solano Counties and enlargement of the Tehama-Colusa Canal (TCC) capacity (SRSA), 2) extension of the Folsom-South Canal and construction of a Hood-Clay connector or similar facility that could convey water from the Sacramento River to the Folsom-South Canal (ARSA); and 3) construction of the Mid-Valley Canal (DESA). The CVP-wide alternatives do not assume construction of new SWP facilities (other than four pumps presently being added to the Banks Pumping Plant) or new Delta water transfer facilities. However, to estimate the maximum amount of water which could be delivered to the DESA, Delta constraints and reregulation requirements were ignored for one alternative.

Needs Analysis and Yield Analysis

The first step in developing CVP-wide water allocation alternatives was the preparation of an independent needs analysis to evaluate CVP water needs of each agency requesting water. Once the needs analysis was completed, a yield analysis was conducted for each CVP-wide water allocation alternative to quantify the CVP yield available to meet identified service area needs. Methods for conducting the needs and yield analyses are presented below.

Needs Analysis

Water Requests. In response to a Reclamation call for requests in 1986 and 1987, requests were received for nearly 4,000,000 acre-feet per year (af/yr) of water for agricultural, M&I, and refuge purposes. In addition, requests were received for the nonconsumptive uses of maintaining instream flows for fisheries and for satisfying recreation requirements.

General Methods for Needs Analysis. Each water request was evaluated for reasonableness according to Reclamation's process for estimating water requirements and for consistency with proposed Reclamation contracting principles. Evaluations utilized information furnished by the requestors, supplemented by readily available information from published reports and interviews with representatives of requesting agencies. This information was compared with Reclamation documents and adjusted as necessary before use in Reclamation estimating procedures. For each requestor, the projected water requirement was compared to currently available firm water supplies to establish the need for new or additional CVP water. Proposed contracting principles and major assumptions that guided the evaluation of water requests are described below.

Eligibility. Only those entities submitting formal requests to Reclamation were considered in the needs analyses. Reclamation recognizes that nonrequesting entities may also have future needs for water and will consider any future requests for water from the CVP subsequent to this water contracting program.

Period of Development. A projected contracting date of 1990 was used for the needs analysis. Agricultural water agencies must be able to achieve full use of contract water within a maximum period of 10 years for districts without existing distribution systems and a history of irrigation. The length of the period of development is a function of the status of distribution systems and the current level of irrigation. M&I water agencies must be able to achieve full use of contract water within 25 years. The longer period is allowed for M&I development in consideration of gradual growth patterns normally associated with urban population and the long-term nature of M&I water supply planning.

Water Conservation. All new or amended CVP contracts are required to include a standard water conservation clause. The clause requires contractors to develop a water conservation plan which contains definite, economically feasible conservation objectives and a schedule for meeting these objectives. The plan is reviewed at 5 year-intervals to determine if objectives are being met and, if not, whether modifications are necessary.

The needs analyses assumed that agencies and their constituent users will adopt economically feasible water conservation measures. Such measures may include but are not limited to the use of canal lining and piping to reduce seepage; careful canal operation (possibly with automation) to minimize operational spillage; flexible delivery schedules that match water user needs; construction of on-farm irrigation systems that match soil, topographic, and cropping conditions; on-farm management practices, such as irrigation scheduling, tailwater reuse, and water measurement that achieve near-potential irrigation efficiencies or improve estimates of actual efficiencies; rate structures and other measures that penalize wasteful practices; and education programs aimed at raising the public's level of water conservation awareness.

Conjunctive Use. Proposed Reclamation contracting principles require safe yield use of local groundwater resources. For purposes of the needs analysis, Reclamation defines safe yield as the volume of water that does not cause a long-term, progressive decline in groundwater levels or a significant degradation of water quality.

For the analyses in this EIS, the requirement to use groundwater up to the safe yield level was assessed in two ways for agricultural, M&I, and refuge agencies. First, in areas currently not overdrafted, including the SRSA and portions of the DESA, groundwater development was required if its development cost, including capital recovery and recurring costs, was approximately equal to or less than the cost of service water rates under the CVP rate setting policy, provided groundwater pumping would not adversely affect water quality. Second, in the overdrafted ARSA and most of the DESA, requestors were required to operate these aquifers to stabilize groundwater levels at their current elevations, regardless of operational costs.

No Irrigation Expansion in Overdraft Areas. Proposed Reclamation contracting principles require that CVP water not be provided for agricultural use to support expansion of irrigated acreage in areas where the groundwater aquifer is overdrafted (ARSA and most of the DESA). Reclamation recognizes that the principles alone will not halt groundwater overdraft if nonrequestors choose to use groundwater to expand irrigated agriculture.

The needs estimates developed for agricultural requestors within areas of overdraft are consistent with this principle. The needs estimates for M&I entities within areas of overdraft did, however, assume future planned urban development would occur because costs of untreated water supplies typically do not affect urban development decisions.

Payment Ability. The ability of agencies to pay water rates proposed for new or expanded CVP water contracts was not used as a criterion in the needs analyses since for purposes of the EIS analyses each agency was assumed to have sufficient revenues to pay Reclamation cost of service rates. Payment ability will be addressed at the time of contract negotiations. If an agency cannot pay the cost of service water rates defined in the CVP rate setting policy, it is up to that agency to prepare a payment capacity analysis to demonstrate that inability to Reclamation. At that time Reclamation may revise the water allocation.

Specific Methods of Needs Analysis for Each Water Use Type

Agricultural. Agricultural water needs of each agency were determined by estimating future agricultural demands, including allowances for application and conveyance losses, and subtracting from this amount projected future supplies from other water sources. Agricultural demands were based on individual crop water requirements derived from Reclamation, DWR, and related sources of data, including consideration of effective rainfall. Crop water requirements were then multiplied by each agency's projected cropping pattern acreages to determine total crop water requirements. Acreages in areas where groundwater is overdrafted were constrained to existing irrigated areas.

For planning purposes and to promote efficient water use under potential future contracts, Reclamation assumed that farmers would apply water with 80 percent efficiency, thereby allowing 20 percent for losses. Additionally, minimal allowances for conveyance losses from district distribution systems were provided; pipeline systems were allowed 5 percent leakage, while canal systems were allowed 10 percent for seepage, spillage, and evaporation. Each agency's future water supply from surface water and groundwater sources was projected giving consideration to water rights and existing surface water contracts and their renewal characteristics. Groundwater safe yields were also estimated for each agency and included in the water supply. Safe yield estimates reflected groundwater quality as well as its physical availability.

Municipal and Industrial. The same basic procedure of projecting future water demands and supplies previously described for agriculture was also used for M&I agencies; however, demands were computed differently. Maximum M&I water delivery requirements were based on projected populations and per capita water use rates. Population projections provided by requesting agencies were checked against other sources and adjusted, if necessary, to reflect probable growth patterns. Similarly, per capita use rates were derived principally from historical records provided by requestors, adjusted as needed to reflect probable future land use and water conservation measures. In addition to general M&I use, special case-by-case analyses of needs were made for industrial and suburban water requirements.

Water Banking. Requests for use of CVP water in conjunctive use groundwater programs in the DESA were reviewed for reasonableness.

Refuges. The ongoing Reclamation-sponsored Report on Refuge Water Supply Investigations has identified refuge water needs within the SRSA and DESA. That study has defined four levels of water supply representing the following conditions.

- o Supply Level 1: the existing firm water supply available to the refuges from water rights and contracts and, in the case of Merced NWR, also from groundwater pumping.
- o Supply Level 2: the existing average annual water supply comprised of firm water plus the average supply from undependable or interruptible sources.
- o Supply Level 3: the annual water supply that would facilitate full use of existing developed lands on each of the refuges.
- o Supply Level 4: the annual water supply that would facilitate optimum management of all lands on each refuge.

The water contracting EIS's investigate providing water to satisfy requirements of Levels 2 or 4; monthly water supplies necessary to meet these requirements are presented in Technical Appendix A - Water Needs Analysis (bound separately). USFWS has preliminarily identified water needs above those for Level 4 to supply proposed future national wildlife refuge acquisitions; these needs are, however, beyond the scope of both the Refuge Water Supply Investigation and the water contracting EIS's.

Instream Flows. Preliminary instream flow needs were recommended by the USFWS and DFG (Appendix I). These values were adjusted by Reclamation, in consultation with these agencies during alternatives development and hydrologic modeling, since available uncommitted CVP yield was determined to be insufficient to fully meet preliminary instream flow needs identified by the agencies (see Table 2-1). Therefore, the final instream flow values used in Alternative 5 were substantially lower than the preliminary needs shown in Table 2-1.

Recreation. Recreation needs for Shasta, Folsom, and Clair Engle Reservoirs were determined by identifying water levels that would benefit recreational uses. Recreation needs for the lower American River were determined by considering flows determined by Sacramento County to be necessary to avoid permanent impairment to recreational values. Recreation needs for the Trinity River were determined with input from Trinity County. (Specific recreation requests considered in the water contracting EIS's are given in Table 2-1.)

Results of Needs Analysis

Table 2-1 presents estimates of CVP water needs in each service area developed using the above methods. Further details regarding the needs analysis are presented in Appendix II and Technical Appendix A - Water Needs Analysis (bound separately).

Table 2-1. CVP Water Requests and Needs

Agriculture, M&I, and Refuge (in thousands af/yr)								
Type of Use	SRSA		ARSA		DESA		Total	
	Request	Need	Request	Need*	Request	Need*	Request	Need
Agriculture	361	262	307	293	1,959	1,871	2,627	2,426
M&I	133	105	303	245	83	68	519	418
Water banking	0	0	0	0	200	200	200	200
Refuge								
Level 2	143	143	0	0	110	110	253	253
Level 4	<u>171</u>	<u>171</u>	<u>0</u>	<u>0</u>	<u>221</u>	<u>221</u>	<u>392</u>	<u>392</u>
Total with:								
Level 2	637	510	610	538	2,352	2,249	3,599	3,297
Level 4	665	538	610	538	2,463	2,360	3,738	3,436

Note: Table does not include DWR request for 500,000 af/yr of interim CVP water pursuant to Section 10(h) of the COA.

*Based on no expansion of irrigated acreage over existing conditions.

Instream Flow Requests (in cubic feet per second)				
Sacramento River below Red Bluff	Normal/ Wet Year 6,000	Dry Year 6,000	Critically Dry Year 4,500	
	Oct - 1,750 Nov - 2,000 Dec - 4,250	Jan - 6,000 Feb - 5,000 Mar - 4,800	Apr - 4,600 May - 4,100 Jun - 3,750	Jul - 3,500 Aug - 3,400 Sep - 3,000

Lower American River Recreation Flow Requests (in cubic feet per second)				
Oct - 2,000	Jan - 2,000	Apr - 3,000	Jul - 2,500	
Nov - 2,000	Feb - 3,000	May - 3,000	Aug - 2,500	
Dec - 2,000	Mar - 3,000	Jun - 3,000	Sep - 2,500	

The water needs estimates developed for the water contracting EIS's are projections based on existing information and are not final estimates. Reclamation will continue to work with water requestors to ensure these estimates reflect the most current information available. The needs estimates therefore do not necessarily represent the final basis for contracts with individual requestors.

Yield Analysis

Operations Planning Model. For each of the CVP-wide water allocation alternatives, Reclamation conducted a yield analysis to estimate the amount of CVP water available for contracting. Reclamation's Operations Planning Model, a computer program, was used to define reservoir levels and river flows for existing (1985) and future (2020) conditions. CVP contract deliveries given in Table 2-2 and instream flow assumptions in Table 2-3 were input as demands for those runs. Computer runs were then made for each water allocation alternative using results of the needs analysis to define demands in addition to the Table 2-2 2020 deliveries. If the model results indicated the available CVP yield was not adequate, the demands were reduced to a level which could be met and the model was rerun to define resulting reservoir levels and river flows. Methods and assumptions used in running the Operations Planning Model are summarized in Appendix III and described in detail in Technical Appendix B - Assumptions and Criteria Utilized in the Operations, Power, Temperature, and Water Quality Models (bound separately).

As described in Appendix III, the Operations Planning Model was used to balance inflows from 40 subareas and storage in six reservoirs with existing and proposed demands. Output from this model, which is discussed in Chapter 4 and presented in detail in Appendix IV, was then input into a power operations model to estimate energy and capacity generation using the planning model releases and any unused reservoir storage. The power model output was then used in temperature and Delta water quality models. While these models provide precise numbers in terms of storage, power generation, flow, temperature, and Delta salinity, the accuracy of the models is dependent on the validity of the assumptions used, the time increment applied, detail of physical description, and the accuracy of the input data.

In terms of the total system accomplishments, the Reclamation models provide a reasonably accurate determination of available water supply, reservoir storage, streamflows, power generation, water temperatures, and Delta salinity. However, because of the complicated steps in balancing river flows and reservoir levels, slight changes in operating rules could produce different results. While the intent of the models is to reflect forecasted operations of the CVP as closely as possible, it is impossible to completely and accurately reflect all aspects of the real time operation with forecasted monthly models. Monthly computer models of necessity operate with average monthly data and very fixed, rigid operating rules. They do not reflect the dynamic day-to-day process that is the real-time operation. Because of these limitations the models may indicate that occasionally a standard is not met, an objective is not achieved, or total storage in the system has a slightly different pattern.

Table 2-2. Northern Central Valley Project
1985 and 2020 Contract Deliveries
For Operation Planning Model Run
(in thousands af/yr)

	1985 Deliveries	2020 Deliveries
<u>Sacramento River Service Area</u>		
Project water	377.0	385.0
Base supply	1,818.0	1,833.2
Bypass and riparian	<u>500.0</u>	<u>500.0</u>
Total Sacramento River diversions	2,695.0	2,718.2
Toyon pipeline	2.0	2.5
Shasta area	<u>1.0</u>	<u>4.6</u>
Total Shasta Lake diversions	3.0	7.1
Clear Creek South	9.3	16.1
Spring Creek conduit	0.7	1.5
Redding, City of	2.0	6.1
Cow Creek south	17.3	24.0
Corning Canal plus losses	49.0	49.8
Tehama-Colusa Canal plus losses	235.0	292.2
Wildlife refuges	60.0 ^a	0.0
Feather Water District diversions	20.0	20.0
Stony Creek diversions	<u>1.1</u>	<u>3.2</u>
Total Sacramento River Service Area	3,092.4	3,138.2
<u>American River Service Area</u>		
Natomas diversions (Folsom and Southern California Water Co.)	30.0	32.0
North Fork ditch (San Juan Suburban Water District)	31.0	33.0
Folsom Prison	<u>1.0</u>	<u>4.0</u>
Total north area water rights	62.0	69.0
El Dorado County CVP Water	2.0	7.5
El Dorado water rights	<u>1.0</u>	<u>47.5</u>
Total El Dorado diversions	3.0	55.0

Table 2-2. Continued

	1985 Deliveries	2020 Deliveries
Placer County CVP water	0.0	117.0
Placer County water rights	9.0	120.0
San Juan Suburban Water District CVP water	11.2	11.2
Roseville, City of	11.0	32.0
FSC--Sacramento County irrigation	10.0 ^a	0.0
FSC--EBMUD	0.0	150.0
FSC--SMUD (60,000 af CVP water)	25.0	75.0
FSC--losses	20.0	20.0
Sacramento, City of	50.0	230.0
Carmichael Irrigation District and riparian	<u>0.0</u>	<u>56.0</u>
Total American River Service Area	201.2	935.2
<u>Delta Export Service Area</u>		
DMC--Mendota Pool	503.0	537.1
DMC--Westlands	50.0 ^a	0.0
DMC--Patterson	6.0	6.0
DMC--State of California	<u>19.0</u>	<u>19.0</u>
Total DMC irrigation	578.0	562.1
SLC--Westlands	900.0 ^b	900.0 ^b
SLC--San Luis Water District	79.0	79.5
SLC--Panoche	44.0	44.0
SLC--Pacheco	9.0	9.0
SLC--miscellaneous	0.0	5.7
SLC--losses	<u>40.0</u>	<u>59.0</u>
Total San Luis Irrigation	1,072.0	1,097.2
SLC--Avenal	2.0	3.5
SLC--Coalinga	5.0	10.0
SLC--Huron	2.0	3.0
SLC--Westlands	<u>6.0^b</u>	<u>11.0^b</u>
Subtotal San Luis M&I	15.0	27.5

Table 2-2. Continued

	1985 Deliveries	2020 Deliveries
Cross Valley Canal	128.0	128.0
Contra Costa Canal	90.0	195.0
DMC--exchange contracts	840.0	840.0
DMC--Schedule II	38.0 ^c	37.3
DMC--grasslands	50.0	50.0
DMC--losses	120.0	120.0
San Felipe irrigation	0.0	65.0
San Felipe M&I	0.0	151.0 ^d
San Luis interim	<u>400.0^e</u>	<u>0.0</u>
Total Delta Export Service Area	3,331.0	3,273.1
Total Sacramento, American, and Delta Export Service Area deliveries	6,624.6	7,346.5

Note: FSC = Folsom-South Canal
 DMC = Delta-Mendota Canal
 SLC = San Luis Canal

^a Interim water contracts.

^b Westlands M&I deliveries are within its 900,000 af contract instead of additional amounts as shown and used in the model.

^c Includes 400-af interim supply.

^d Total amount committed; however, 19,000 af is reserved for the Pajaro Valley Water Management Agency or Santa Clara County Water District and San Benito County and is not currently under contract.

^e Includes 250,000-af provisional supply and 150,000-af interim supply.

Table 2-3. Summary of Instream Flow Assumptions

Trinity River. The following minimum flows from Lewiston Reservoir for the Trinity River were established on January 14, 1981, by the Secretary of the Interior (monthly flows shown are those used in the model studies):

- o Normal/wet year: Increasing from 287,000 af/yr to 340,000 af/yr as habitat and watershed restoration measures are implemented and evaluated. Average monthly flows: September through February - 300 cfs; March - 450 cfs; April - 600 cfs; May - 800 cfs; June - 700 cfs; July - 600 cfs; August - 400 cfs.
- o Dry year: 220,000 af/yr. Average monthly flows: June through February - 300 cfs; March - 250 cfs; April - 200 cfs; May - 500 cfs.
- o Critically dry year: 140,000 af/yr. Average monthly flows: October through February - 300 cfs; March, April, and June - 100 cfs; May and August - 200 cfs; July - 150 cfs; September - 125 cfs.

Sacramento River. Keswick releases meet the requirements of the memorandum of agreement dated April 5, 1960, between Reclamation and DFG:

Period	Normal Year (cfs)	Critically Dry Year (cfs)
January 1 through February 28 ^a	2,600	2,000
March 1 through August 31	2,300	2,300
September 1 through November 30 ^a	3,900	2,800
December 1 through December 31 ^a	2,600	2,000

^a Letter dated October 8, 1981, changed normal year minimum releases to 3,250 cfs for the October 1, 1981, through February 28, 1982, period. (The 3,250-cfs flow has continued to be in effect since that period and has been used for the EIS evaluations.)

American River. The current minimum flow standard for the American River is described in SWRCB Decision 893 (D-893). Increased minimum flow requirements are described in SWRCB Decision 1400 (D-1400) and are to be implemented if Auburn Dam becomes operational. The Operations Planning Model uses the D-893 flows as minimums for all alternatives.

Sacramento-San Joaquin Delta. Reclamation and DWR recently agreed to coordinate the operation of the federal and state water projects to meet Delta water quality standards similar to those described in D-1485, not including Suisun Marsh standards.

Note: See Appendix 1 for a more detailed description of these assumptions.

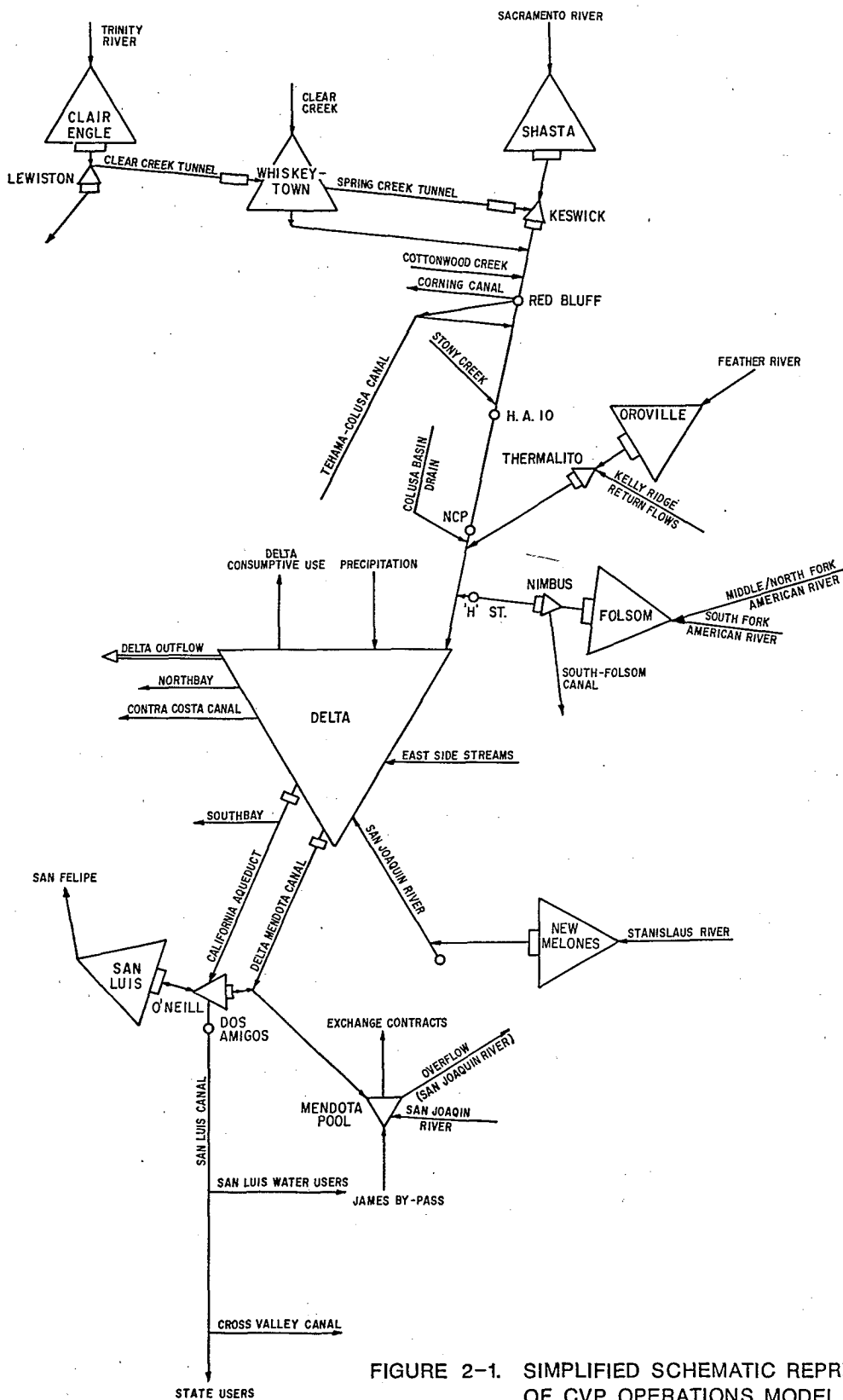


FIGURE 2-1. SIMPLIFIED SCHEMATIC REPRESENTATION OF CVP OPERATIONS MODEL

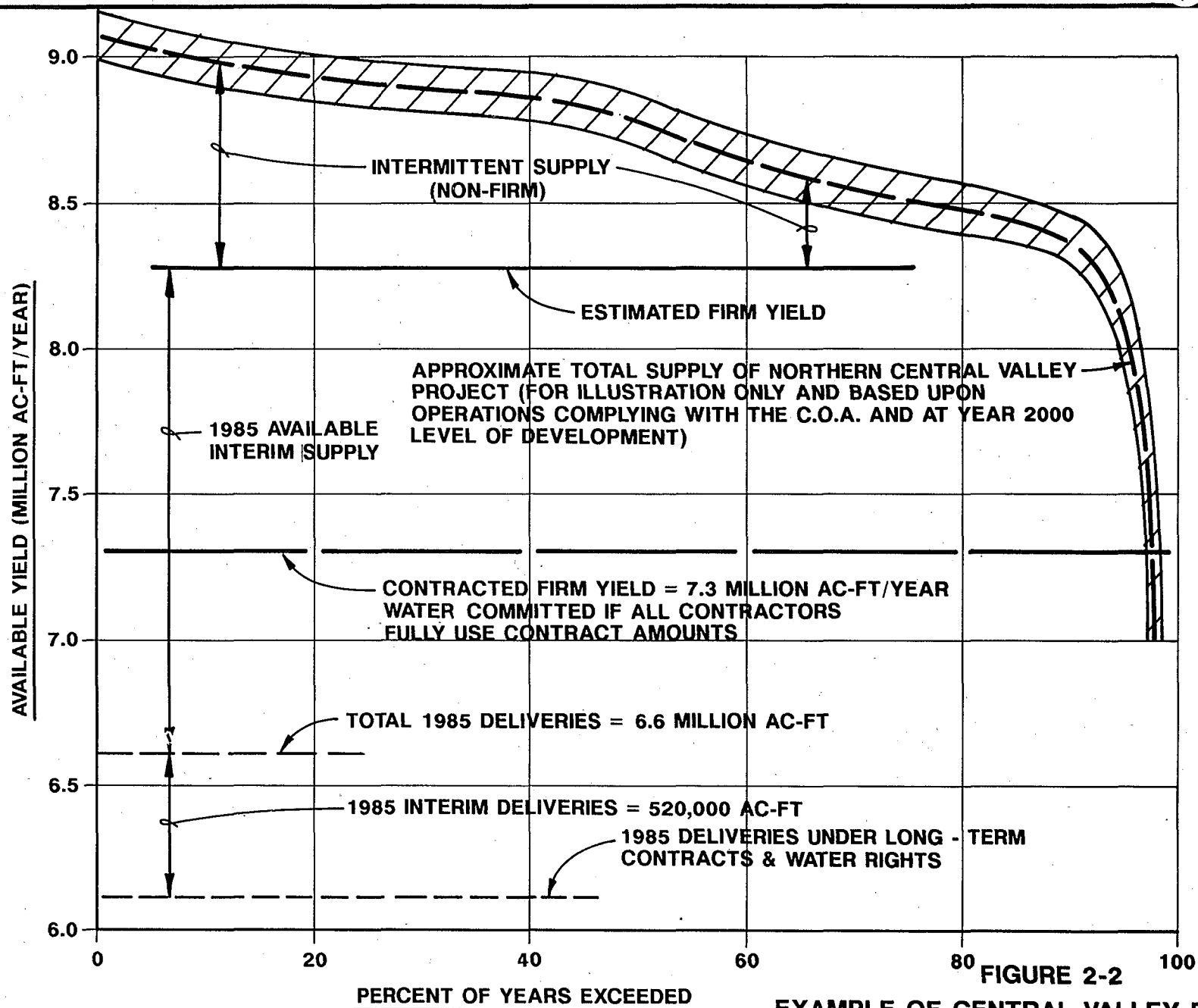


FIGURE 2-2
EXAMPLE OF CENTRAL VALLEY PROJECT
YIELD-DURATION CURVE

The real value of the models is in the comparison of alternatives. When used for this purpose the models are useful and accurate tools. In comparing alternatives it is important to recognize the model limitations and the greater flexibility of real-time operations. In real-time operations, standards will be met, objectives can be achieved, and reservoir storages can be balanced with less than significant impacts on other project accomplishments.

The models used in this analysis are the best available at this time; however, modeling is a process involving continuous changes and improvements. Hydrologic information and modeling techniques are constantly being improved. DWR and Reclamation are in the process of updating the Central Valley Basin depletion analysis and Reclamation is currently modifying the Operations Planning Model. However, improvements to the hydrologic data base and the model are not expected to result in any significant changes in the comparative nature of the yield analysis. The absolute value of yield estimates for the 2020 No-Action condition and the allocation alternatives will change because of these improvements and an error in subtraction of storage reservation requirements resulting from the depletion analysis estimates used in the Operations Planning Model runs. This could result in firm yield values up to 300,000 af/yr less than used in the EIS analyses. Because of this, the models will be rerun for the Final EIS's. Where changes are necessary, DESA allocations will be reduced. Other adjustments to output from the models for the EIS analyses are described in Appendix III. Output from the model runs is included in Technical Appendix C - Operations and Temperature Model Output (bound separately).

Features and facilities affecting the water supply of the Central Valley are shown schematically in Figure 2-1. Regulating facilities that are operated explicitly in the Operations Planning Model include Clair Engle, Whiskeytown, Shasta, Folsom, Oroville, and San Luis Reservoirs. Hydrology used in the model includes effects of operation of other significant Central Valley basin reservoirs. New Melones Reservoir is operated in a separate model, and the resulting flow of the San Joaquin River at its mouth is input to the Operations Planning Model. A set of data describing the operation of the SWP at a given level of development are furnished by DWR and used as input to the Operations Planning Model.

Firm, Intermittent, and Interim Supplies. The availability of water to meet authorized purposes of the CVP has traditionally been defined in terms of its ability to meet project needs within specific periods of time. These categories of supply include firm yield, intermittent yield, and interim water. (See Figure 2-2 for graphical representation.)

Firm Yield. Firm yield has traditionally been defined as the water supply that is available throughout an historic period of record (subject to deficiencies in critically dry years) from CVP operation at an ultimate level of development. Ultimate development is the development that will exist at full water delivery (buildout) of contract and water right commitments (traditionally equated to 2020 level of development). Firm yield calculations are based on the driest series of years that occurred in the Central Valley, from 1928 through 1934. To take advantage of the abundant water supplies available in normal years, deficiency criteria have been established to moderate the effect of this critically dry period on firm yield determinations. Reclamation computes firm yield with an allowance for deficiencies totaling 100 percent of 1 year's supply during the 7-year, 1928 through 1934 dry

period. Twenty-five percent deficiency is taken in the critical dry years of 1929, 1931, 1933, and 1934.

Intermittent Yield. In wet, normal, and some dry years, additional water is available after commitments for firm yield supplies are met. This supply is termed intermittent yield. Intermittent water may be used in combination with groundwater through a conjunctive use program to expand the total supply of water available for contracting by Reclamation. This water could be contracted on an annual, short-term (longer than 1 year but less than 20 years), or long-term (up to 40 years) basis. The amount of surface water delivered under this kind of supply contract is not as dependable as firm yield since the intermittent supply depends on the wetness of the water year and the priority needs of CVP firm yield contractors.

The dependability of an intermittent supply can be calculated on the basis of past hydrology and the ability to meet firm yield demands. Figure 2-2 shows the relationship between the percent of years an intermittent supply can be delivered and the amount of intermittent supply that can be delivered. The available supply of intermittent water decreases at an accelerating rate as the probability of occurrence increases. Based on Figure 2-2, about 700,000 af/yr of intermittent water would be available 10 years out of 100, about 400,000 af/yr would be available 60 years out of 100, and no intermittent water would be available 10 years out of 100.

Interim Water. Interim water is the difference between the firm yield of the CVP and total contract deliveries of firm yield at any level of development. At the 2020 level, contract deliveries are expected to be at or near their maximums; interim supply, therefore, would be practically zero. Interim water can be contracted whenever contract deliveries are less than the total CVP firm yield. The amount of interim supply will decrease over the years but will be available for contract delivery for agricultural, M&I, fish and wildlife, instream flow, or recreation uses. It is expected to decrease from the 1985 level of 2.2 million af/yr shown in Figure 2-2 to in the order of 800,000 af/yr in 2000, if additional contracting is implemented.

CVP-Wide Water Allocation Alternatives

Summary of Operation Planning Model Results

Seven CVP-wide water allocation alternatives in addition to the No-Action Alternative, were developed to reflect Reclamation's water contracting objectives and the concerns expressed during the public scoping process. Table 2-4 summarizes the allocations of available firm and intermittent yield to the three service areas under each CVP-wide alternative.

The CVP-wide water allocations are alternate ways of allocating available firm and intermittent yield totals to each service area. They are the framework for the more detailed service area alternatives presented later in this chapter. The service area alternatives allocate firm and intermittent yield to individual service area requestors.

Table 2-4. CVP-Wide Yield Allocations by Alternative
(in thousands af/yr)

Alter- native	Sacramento River Service Area						American River Service Area				Delta Export Service Area						Total Allocations	
	Firm			Intermittent			Firm		Inter- mittent		Firm			Intermittent			Firm Yield	Inter- mittent Yield
	Ag	M&I	Refuge	Ag	M&I	Refuge	Ag	M&I	Ag	M&I	Ag	M&I	Refuge	Ag	M&I	Refuge		
1A	175	5	0	87	100	143	109	178	183	68	269	1	0	187	0	110	737	878
1B	75	5	0	187	100	171	0	152	293	93	344	23	0	45	0	221	600	1,110
2	175	5	0	0	0	0	109	178	0	0	269	1	0	0	0	0	737	0
3	262	105	0	0	0	143	293	245	0	0	328	11	0	147	0	110	1,244	400
4A/B	175	5	0	0	0	171	109	178	0	0	682	27	0	0	0	221	1,176	391
4C/D	0	0	0	0	0	143	0	0	0	0	1,707	27	0	147	0	110	1,735	400
5	0	0	171	0	0	0	0	0	0	0	0	0	220	0	0	0	391	0
6	175	5	143	0	0	0	121	196	0	0	321	18	110	396	4	0	1,089	400
7	0	0	0	0	0	171	0	0	0	0	0	0	0	0	0	220	0	391

No-Action Alternative

Under the No-Action Alternative, no new long-term contracts would be signed for available CVP yield. This alternative was developed to meet NEPA requirements and to serve as a baseline for assessing the impacts of other alternatives.

The No-Action Alternative assumes that existing firm yield contractors would reach their contract maximums by 2020 and would exercise any renewal rights when their contracts expire. Generally, Reclamation law and Reclamation policies allow existing CVP contractors to renew their contracts, provided that the contract maximums are being used beneficially on appropriate lands, subject to changes in certain specific contract terms and conditions (e.g., to allow Reclamation Reform Act compliance).

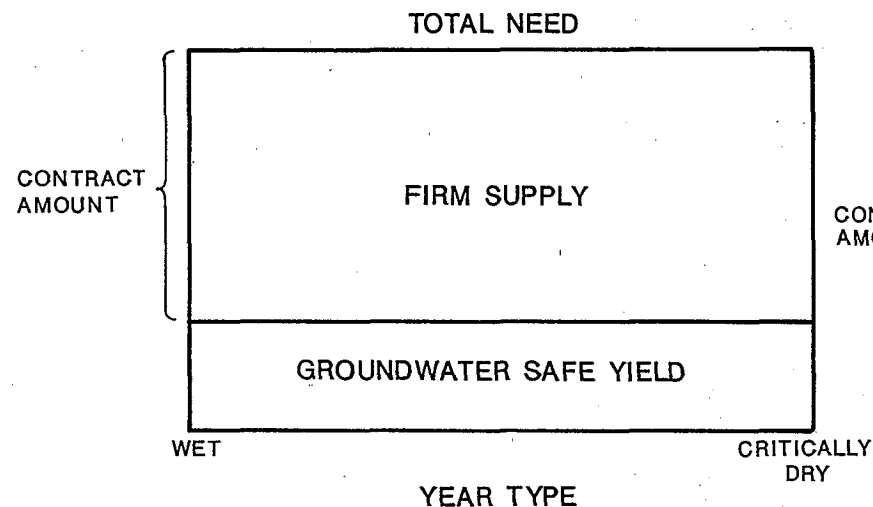
The No-Action Alternative assumes full delivery of quantities permitted under existing CVP water contracts. A breakdown of 2020 deliveries (as used in the Operations Planning Model) by authorized units is given in Table 2-2. Most increases in deliveries will occur in the ARSA, with a projected increase of 364.8 percent from 1985 to 2020. The SRSA projected increase in the SRSA is 1.5 percent over the same period, while the DESA is projected to decrease by 1.7 percent. Total deliveries would change by 10.5 percent. Adjustments made to these deliveries for purposes of the EIS analyses are described in Appendix III. Reclamation recognizes that in the absence of additional water contracting, interim and provisional water deliveries listed under the 1985 deliveries column of Table 2-2 would also be made in 2020.

Alternative 1 - Dependable Supply Contracting

Firm yield available for contracting is far less than the 3.4 million af/yr of need. For this reason, Reclamation has considered dependable supply contracting to increase the amount of CVP water available to meet service area needs. Dependable supply contracting would reduce the amount of firm yield contracted, thereby increasing the amount of intermittent yield available. A comparison of firm yield contracting and dependable supply contracting is shown in Figure 2-3.

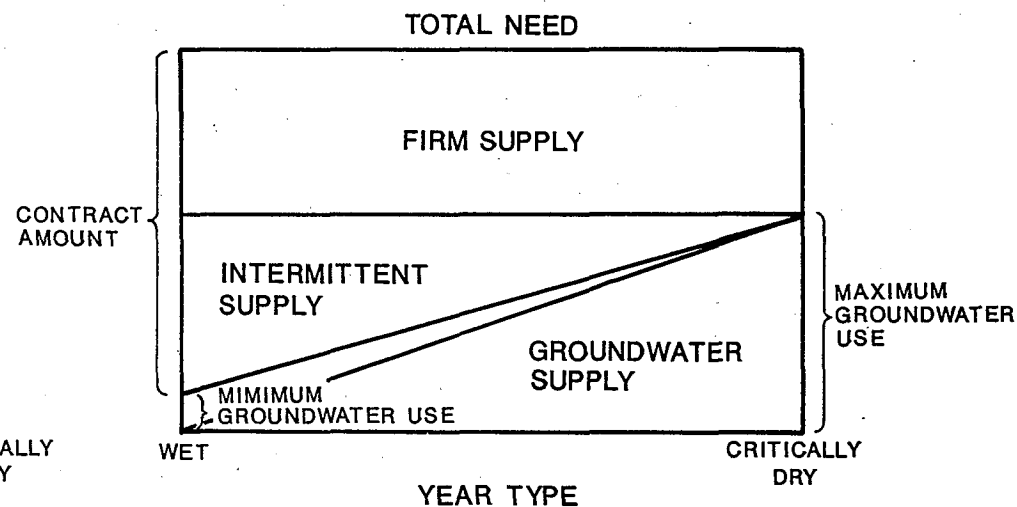
Deliveries of intermittent yield on a dependable supply contract basis would be adjusted according to the wetness of the year as measured by the Sacramento River Basin Index (see Glossary). The delivery frequency shown in Table 2-5 was developed for the TCC, based on delivery limitations of the TCC and estimated safe groundwater yields of agencies allocated intermittent yield, to provide sufficient surface water during the 57-year hydrologic period so the groundwater basin would not be overdrafted. A similar frequency resulted based on intermittent yield deliveries in the ARSA to limit groundwater use to safe yield levels over the 57-year hydrologic period used for the EIS analyses.

FIRM YIELD CONTRACTING



Average use of groundwater in conjunctive use operation is equal to safe yield.

DEPENDABLE SUPPLY CONTRACTING



The magnitude of minimum and maximum groundwater pumping and firm surface water supply provided is dependant on the physical characteristics of the groundwater basin.

FIGURE 2-3. DEPENDABLE SUPPLY CONTRACTING CONCEPT

Note: For illustration of concept only.

Table 2-5. Frequency of Intermittent Water Delivery Based on Type of Year

Type of Year	Percent of Contract Amount Delivered	Percent of 57 Years in Year Type	Cumulative Percent of Time Delivery is Equaled or Exceeded
Wet	80 to 100	35	35
Above Normal	60 to 80	16	51
Below Normal	35 to 60	18	69
Dry	25 to 35	14	83
Dry Following Critical	0 to 25	3	86
Critical	0	14	100

For the 57-year hydrologic period used in the CVP water yield analyses these percentages result in about 60 percent of the total water need being supplied by surface water. The maximum amount of dependable agricultural and M&I deliveries in the SRSA and ARSA is assumed to be equal to additional CVP needs plus groundwater safe yields; i.e., total water needs. Deliveries to the DESA would be limited to pump and canal capacities.

Under a dependable supply contracting approach, the CVP supply could be supplemented with groundwater or local surface water supplies during normal, dry, and critical years to meet needs. A number of operational refinements are possible to minimize costs associated with use of two types of water. These include using wells during the early portion of dry years to meet adjacent or downstream needs and replacing that water with reservoir water during peak need periods, thereby reducing the number of wells required.

Two options, differing in the emphasis placed on dependable supply contracting, have been developed for Alternative 1. Reclamation developed the two options to allow analysis of the advantages and disadvantages of varying degrees of dependable supply contracting, and to obtain public comments on alternative means of achieving the proposed CVP-wide allocation. Options 1A and 1B are described in more detail below.

Option 1A: Partial Dependable Supply Contracting. This option would allocate firm yield to requestors within constructed units up to the limit of existing facility capacities, with all other allocations being intermittent yield. Under this option, firm yield water would be allocated to meet the agricultural and M&I needs of all requestors within constructed units where Reclamation's past water contracting programs have not been completed, limited to the amounts that can be delivered using existing facilities.

Intermittent yield would be allocated under this option to three types of requestors: first, to supplement firm yield allocations to area of origin requestors within constructed units whose needs would not entirely be met with firm yield allocations due to facility limitations (once facilities have been constructed by the requestors to obtain such water); second, to provide requestors outside constructed units with CVP water (in facilities constructed by the requestors) for use in conjunction with other surface water or groundwater supplies to develop a firm supply; and third, to refuges, which would receive Level 2 supplies. The delivery of intermittent water to certain requestors would require construction of new facilities to increase conveyance capacities. Reclamation recognizes that this option may result in the allocation of some intermittent yield to agencies that do not have developable groundwater to firm up the intermittent surface water supply, and that those agencies will need to develop alternate surface water supplies or join with neighboring agencies in a regional groundwater development.

Option 1B: Full Dependable Supply Contracting. Under this option, firm yield water would be allocated only to those requestors without a developable groundwater supply; the developability of a groundwater supply would be determined considering physical availability, groundwater quality, and costs. All other area of origin requestors, and DESA requestors (limited to the supply available) with dual systems already in place, would be offered dependable supply contracts. Refuges would receive Level 4 supplies of intermittent water. Option 1B, as compared to Option 1A, would rely more heavily on dependable supply contracting in the area of origin to increase the amount of CVP water available.

Alternative 2 - Agricultural and M&I Needs Within Constructed CVP Units

This alternative gives priority to agricultural and M&I uses consistent with original CVP authorizing legislation. Under this alternative, CVP water would not be allocated to refuges. However, 25 percent of the available CVP firm yield is reserved for future needs under Alternative 2 and could be made available to refuges.

This alternative was developed to give priority to needs within constructed CVP units where Reclamation's past water contracting programs have not been completed (i.e., Sacramento Canals Unit, American River Division, San Luis Unit, Delta Division, and San Felipe Unit service areas). These firm yield allocations are limited by the remaining capacity of existing facilities. Water is not provided to authorized but currently unconstructed units, to other proposed unconstructed projects, or to refuges. A portion of the firm yield and all intermittent yield is allocated to meet future needs. Capacity limitations which restrict allocations under this alternative include the following: TCC can only deliver an additional 144,000 af/yr on an irrigation pattern, although capacity would be available in other than peak crop consumptive use months; the American River Division has a remaining yield of about 290,000 af/yr when delivered on the irrigation and M&I pattern required by Alternative 2; and the Delta Division can only deliver an additional 270,000 af/yr on a pattern to meet irrigation and M&I requirements for this alternative.

Alternative 3 - Agricultural and M&I Needs in Areas of Origin

This alternative is similar to Alternative 2 in that it gives preference to agricultural and M&I needs, but with first priority to areas of origin. It was developed to give priority to existing agricultural and M&I needs within areas of origin, in consideration of established State of California policies contained in the County of Origin and Watershed Protection Statutes. Priority for firm yield allocations is then given to Delta Export needs within constructed CVP units. Under this alternative, available intermittent yield is allocated to meet refuge Level 2 needs plus water banking needs in the DESA. A number of new facilities would be required to implement this alternative. In the SRSA, delivery to the TCC Service area would require raising the canal lining and/or providing regulation storage. Intermittent water could be delivered to refuges along the TCC during nonpeak canal use periods, however, this requires some adjustment in the requested delivery pattern. Deliveries to the Yolo-Solano area would require enlargement of the TCC, including regulation storage (similar to the previously proposed Sites reservoir), and a conveyance connection to the TCC. Alternatively, pumping from the Sacramento River near Yolo County or at the North Bay Aqueduct could provide a means to deliver the CVP water. Deliveries in the ARSA would require a Hood-Clay connector or similar facility to deliver the Sacramento River water allocated plus extension of the Folsom-South Canal. DESA deliveries would require a wheeling agreement with DWR for use of the Harvey O. Banks Pumping Plant and California Aqueduct.

Alternative 4 - Agricultural and M&I Needs in the Delta Export Service Area

This alternative is also similar to Alternative 2 in that it gives preference to agricultural and M&I needs, but it gives priority for firm yield allocations to existing agricultural and M&I needs within the DESA. The alternative was proposed to maximize regional and national economic return from irrigated agriculture. Four subalternatives are included within this alternative.

Under Alternative 4A/B, deliveries within the DESA would be limited to use of remaining capacity in the Delta-Mendota Canal and the federal portion of San Luis Reservoir and Reclamation use of remaining capacity of DWR's existing facilities (Harvey O. Banks Pumping Plant, California Aqueduct, and San Luis Reservoir). The remaining firm yield would be allocated to SRSA and ARSA needs within constructed CVP units.

To permit delivery of all available firm yield to the DESA, deliveries under Alternative 4C/D would not be limited to the capacity of existing facilities. This would require major new facilities including reregulation storage south of the Delta and cross Delta facilities.

Available intermittent water would be allocated to refuge Level 4 needs under Alternative 4A/B and to refuge Level 2 and Delta Export water banking needs under Alternative 4C/D. Delivery of DESA refuge water would require reregulation storage south of the Delta under Alternative 4A/B and additional conveyance capacity under Alternative 4 C/D. In the SRSA, refuge water could be delivered by the TCC under Alternative 4 C/D but would require an Alternative 3 type arrangement under Alternative 4 A/B.

Alternative 5 - Refuge and Instream Flow Needs

This alternative gives preference to maintenance and enhancement of Central Valley fish and wildlife resources. Under this alternative, refuge needs would be met with firm yield based on refuge Level 4 estimates of the Report on Refuge Water Supply Investigations. Instream flow needs for fish and wildlife, as identified by the USFWS and DFG, would be met with firm yield to the extent possible. These needs were prioritized (Appendix I) given the available yield, by Reclamation in consultation with the USFWS and DFG. Under this alternative, available intermittent water would be allocated to increase Delta outflow. Because the amount of available CVP yield is limited, this alternative does not provide amounts of water for fish and wildlife that are considered optimum by USFWS and DFG.

Alternative 6 - Refuge Needs, M&I Needs Within Constructed CVP Units, and American River Instream Flow Needs

This alternative gives preference to a number of contracting objectives, and to American River instream flow needs identified as important during the scoping process. It was developed to give priority to a mix of refuge, M&I, and instream flow needs to allow evaluation of a hybrid alternative. First, refuge needs would be met with firm yield based on Level 2 needs. Second, M&I needs within constructed CVP units would be met. Third, American River instream flow needs for both fisheries and recreation up to those in federal legislation proposed in 1987 (House Resolution 1605) would be met. Remaining CVP firm yield would be allocated to needs within constructed units (See Alternative 2). Under this alternative, available intermittent water would be allocated to water banking and Mid-Valley Canal needs in the DESA. Under this alternative, refuge water deliveries would require facilities or arrangements as described for Alternative 4 A/B. Sacramento River water would be delivered for Sacramento County agricultural needs and would require a diversion/pumping facility near Hood. Deliveries to the DESA would require wheeling arrangements as described for Alternative 4 A/B plus reregulation storage south of the Delta for the refuge water deliveries.

Alternative 7 - Recreation Needs

This alternative gives preference to selected recreational needs associated with the lower American and Trinity Rivers, and with Shasta, Clair Engle, and Folsom Reservoirs.

It was developed to give priority to selected recreation needs identified as important during the scoping process. It would not optimize the use of available CVP yield for all recreation activities at all CVP facilities, but rather responds to specific priorities identified during scoping. Under this alternative, priority for firm yield allocations would be given first to maintaining water-based recreation in the lower American River, and then to maintaining water levels in Clair Engle, Shasta, and Folsom Reservoirs. Available intermittent water would be allocated to meet refuge Level 4 needs.

Proposed CVP-Wide Water Allocation

A proposed CVP-wide water allocation was selected to develop a consistent proposed contracting action in each service area and to maximize the available water supply among the variety of competing beneficial uses. The proposed CVP-wide water allocation would allocate available CVP-wide yield to each of the three service areas and accomplish the authorized objectives of the CVP. Proposed actions for each of the three service areas would then allocate the service area total to individual requestors.

Proposed Action

During the process of formulating alternatives to depict options with a broad spectrum of environmental consequences, it became apparent that the number of possible combinations of water allocations is essentially unlimited. It also became apparent that selecting a proposed action would depend in great measure on existing and projected CVP capability and the public comments received on this document. However, in keeping with the stated purpose of optimizing the amount of water available, it is necessary to consider the attributes of all alternatives analyzed. Reclamation's proposed action contains elements of several of the alternatives and is based, in part, on the following criteria:

- o Water would be allocated to areas for which major conveyance facilities exist and construction of only minor facilities are required to make additional deliveries. In some cases it may also be necessary to enter into agreements for use of conveyance facilities owned by others, and to construct local distribution facilities.
- o Water would be allocated to areas which are presently authorized for service.
- o Water would be allocated to the areas of origin to the extent there is conveyance capacity for delivery.
- o Water would be allocated to meet the full needs of the wildlife refuges.
- o Water would be allocated in a way which strongly encourages conjunctive use for agriculture, M&I, and refuges in order to increase the existing water supply and maximize the use of this valuable California resource.
- o Consideration would be given to integration of local groundwater supplies into available CVP supply in order to increase California's total water supply and assist areas with payment capacity limitations.

Three types of allocations would be made: firm, conditional, and intermittent. The firm water allocation is firm yield which can be delivered from existing CVP facilities. The conditional allocation consists of firm yield water available to Reclamation which requires access to the conveyance facilities of others. The intermittent allocation is water available in some years, some of which (north of the Delta) can be conveyed in CVP facilities, and some of which is dependent on capacity in existing non-Reclamation facilities. Proposed

CVP-wide allocations, and tentative proposed allocations to individual agencies within each service area, are given in Table 2-6.

In the SRSA approximately 15,000 af/yr of firm water and 160,000 af/yr of intermittent water would be allocated to agricultural use, 4,800 af/yr of firm water would be allocated to M&I use, and 171,000 af/yr of intermittent water would be allocated to wildlife refuges. In the ARSA approximately 317,000 af/yr of water would be allocated to areas in Sacramento County. M&I uses would receive 174,200 af/yr of firm water and 22,050 af/yr of intermittent water, and agriculture would receive 60,450 af/yr of firm water and 60,450 af/yr of intermittent water. The final mix of firm and intermittent may be adjusted depending on the capability of groundwater basins to be used in conjunction with intermittent supplies.

In the DESA approximately 309,000 af/yr of firm water would be allocated, primarily for agricultural use. Two hundred thousand af/yr of conditional water and 371,000 af/yr of intermittent water would be allocated, delivery of which would be dependent on access to capacity in DWR facilities. As mentioned in the "Yield Analysis" section of this chapter, DESA allocations may be reduced when the Operations Planning Model is re-run for the Final EIS's.

Interim Water

An estimated 800,000 af/yr of CVP firm yield water would be available for interim contracting during the next 20 years. This estimate assumes that about 500,000 af/yr from existing long-term contracts and about 25 percent of new long-term contracts will be available for interim contracting. A separate method is needed for allocation of interim water; the proposed CVP-wide allocation and alternatives allocate all available water as firm or intermittent yield because they are based on Operations Planning Model runs which assume full buildout (i.e., no available interim water) in 2020.

Reclamation proposes the following method of contracting interim water. Interim water would be used for up to 10 years to make intermittent allocations firm until alternative supplies have been developed. Interim water would be allocated to those intermittent water contractors without existing alternative supplies based on the contractor's ability to use the water. Preference would be given to contractors located in an overdraft area. Interim water would also be allocated to the state under a 10(h) wheeling agreement. The amounts of interim water allocated to the state and others would be reduced over time as intermittent contracts are signed, and as firm yield contracts build out.

Environmental impacts of contracting interim supplies would depend on the amount of interim water contracted and the length of interim contracts. In general, regional and cumulative impacts of contracting all interim water on reservoir levels, stream flows, and water-related resources would be similar to those described for the proposed CVP-wide water allocation in 2020. Interim contracting would, however, cause the regional and cumulative impacts to occur earlier than 2020. Site-specific impacts of contracting interim supplies would generally be similar to site-specific effects of contracting firm or intermittent supplies.

Table 2-6. Proposed CVP-Wide Water Allocation
(in af/yr)

Area/Agency	Principal Type of Use	Water Allocation			
		Firm	Conditional ^a	Intermittent	Total
<u>SRSA^e</u>					
Shasta Dam Area Public Utility District	M&I	4,800	-	-	4,800
<u>Sacramento Valley Canals Agencies^b</u>					
Colusa County Water District	Ag	-	-	50,000	50,000
Corning Water District	Ag	-	-	7,800	7,800
Dunnigan Water District	Ag	-	-	5,100	5,100
Glenn-Colusa Irrigation District	Ag	-	-	23,800	23,800
Glenn County Lands ^a	Ag	-	-	20,200	20,200
Glide Water District	Ag	-	-	9,700	9,700
Holthouse Water District	Ag	-	-	2,500	2,500
Orland-Artois Water District	Ag	-	-	33,400	33,400
Rancho Saucos Water District	Ag	-	-	3,600	3,600
Tehama Ranch Mutual Water Company	Ag	-	-	1,400	1,400
Yolo-Zamora Water District	Ag	15,000	-	2,800	17,800
Colusa National Wildlife Refuge ^c	Refuge	-	-	25,000	25,000
Delevan National Wildlife Refuge ^c	Refuge	-	-	30,000	30,000
Gray Lodge Wildlife Management Area	Refuge	-	-	36,000	36,000
Sacramento National Wildlife Refuge ^c	Refuge	-	-	50,000	50,000
Sutter National Wildlife Refuge	Refuge	-	-	30,000	30,000
Subtotal SRSA		19,800	-	331,300	351,100
<u>ARSA</u>					
Folsom, City of	M&I	20,900	-	-	20,900
Mather Air Force Base	M&I	350	-	-	350
<u>Multi-District Area^b</u>					
San Juan Suburban Water District	M&I	26,100	-	-	26,100
Citizens Utility Company	M&I	10,800	-	10,800	21,600
Northridge Water District	M&I	6,600	-	6,600	13,200
McClellan Air Force Base	M&I	1,250	-	1,250	2,500
Rio Linda County Water District	M&I	3,400	-	3,400	6,800
<u>Sacramento County Water Agency^b</u>					
Area 1	Ag	14,500	-	14,500	29,000
Area 3	Ag	23,050	-	23,050	46,100
Omochumnes-Hartnell Water District	Ag	6,000	-	6,000	12,000
Galt Irrigation District	Ag	15,550	-	15,550	31,100
Clay Water District	Ag	1,350	-	1,350	2,700

Table 2-6. Continued

Area/Agency	Principal Type of Use	Water Allocation			Total
		Firm	Conditional ^a	Intermittent	
Galt, City of	M&I	9,900	-	-	9,900
Laguna/Elk Grove	M&I	77,700	-	-	77,700
Sunrise East area	M&I	<u>17,200</u>	-	-	<u>17,200</u>
Subtotal ARSA		234,650	-	82,500	317,150
DESA					
Panoche Water District	Ag	-	23,000	-	23,000
Pleasant Valley Water District	Ag	-	40,000	-	40,000
San Luis Water District	Ag	-	35,000	-	35,000
Westlands Water District	Ag	250,000	100,000	-	350,000
Mid-Valley Water Authority Agencies	Ag	-	-	190,000	190,000
San Felipe Unit	Ag/M&I	19,000	-	-	19,000
City of Dos Palos	M&I	-	1,300	-	1,300
Veterans Admin.	M&I	-	850	-	850
Grassland RCD	Refuge	-	-	130,000	130,000
Kesterson National Wildlife Refuge	Refuge	6,500	-	-	6,500
Los Banos National Wildlife Refuge	Refuge	18,800	-	-	18,800
Mendota Wildlife Management Area	Refuge	-	-	5,050	5,050
Merced National Wildlife Refuge	Refuge	-	-	4,000	4,000
San Luis National Wildlife Refuge	Refuge	14,700	-	4,300	19,000
Tranquility G. C.	Refuge	-	-	300	300
Volta Wildlife Management Area	Refuge	-	-	6,000	6,000
Kern National Wildlife Refuge	Refuge	-	-	25,000	25,000
Pixley National Wildlife Refuge	Refuge	-	-	<u>6,000</u>	<u>6,000</u>
Subtotal DESA		309,000	200,150	370,650 ^d	879,800
TOTALS		563,450	200,150	784,450	1,548,050

^a Firm water subject to available capacity in the California Aqueduct, and dependent upon a permit to pump at Banks.

^b Final mix of firm and intermittent may be adjusted depending on the capability of the groundwater basins.

^c Requires use of the Red Bluff Diversion Dam during the winter salmon run, or an alternative delivery facility, and due to TCC capacity limitations, can only be delivered during non-peak irrigation months.

^d Subject to available capacity in the California Aqueduct, and dependent upon a permit to pump at Banks.

^e Based on information available at the time of preparation of the Draft, no allocation was made to the Yolo-Solano agencies in the proposed action. However, more recent information indicates that the agencies, consistent with the criteria set forth on page 2-25, merit preferential consideration for an allocation of 142,400 af/yr of water.

Offstream Storage at Wetland Habitat

Reclamation is studying the potential of developing additional CVP yield that could be produced by using wetland habitats for offstream storage. Under this concept, return flows from CVP water delivered to federal, state or privately managed wetlands would be integrated with the rest of the CVP supply. Preliminarily, it is estimated that, based on Level 4 supplies, Sacramento Valley wetland habitats could produce at least 60,000 af/yr of additional yield and that San Joaquin Valley wetland habitats could produce at least 46,000 af/yr of additional yield through utilization of return flows. If Level 2 supplies were allocated to refuges, proportionately less additional return flows (50,000 af/yr from Sacramento Valley wetland habitats and 23,000 af/yr from San Joaquin Valley wetland habitats) would be available for contracting. These amounts represent additional firm CVP supplies available for contracting in the future.

Following completion of Reclamation's studies of wetland habitat offstream storage, more definite estimates of potential additional yield will be available. At that time, Reclamation will consider allocation of any additional yield and contact potential contractors to determine their interest in participating in specific offstream storage projects.

Alternatives Considered but Eliminated from Detailed Study

The CVP-wide alternatives described above represent a full range of reasonable alternatives for allocating available CVP yield, and were developed in response to input received during the scoping process. During and following the scoping process, a number of additional alternatives were suggested, some of which were CVP-wide, and others of which were service-area specific. As explained below, these additional alternatives were not added to the EIS process because their intent or components are already incorporated into these selected CVP-wide alternatives, or because they did not achieve Reclamation's water contracting program objectives.

Allocate Enough CVP Water to Meet All Identified Needs. (3.4 million af/yr)

The remaining yield of current CVP facilities is not sufficient to meet all identified needs. Under a dependable supply contracting approach, about 2 million af/yr could be delivered in wet years (about 60 percent of the identified needs). This allocation is made in Alternatives 4 C/D and 1B.

Reserve Water in Each Alternative for Increased Delta Water Quality Standards that May Result from Bay-Delta Hearings

The No-Action Alternative would not allocate remaining CVP yield to new contracts, and CVP yield would be available for meeting potential Delta water quality standards changes. For other alternatives, including the Proposed Action, contract water shortage and

apportionment clauses would allow cutbacks in the amount of CVP water to be delivered to CVP users if additional yield is needed to meet new water quality standards.

Allocate Remaining Yield for Increased Water Quality Standards, Instream Flows, Refuge Water Supplies, Reducing Groundwater Overdraft, and M&I Uses

This alternative combines components of several CVP-wide alternatives, including Alternatives 5 and 6. The impacts of each component are analyzed in the EIS. Allocation of remaining yield for increased water quality standards is discussed under the alternative immediately above. Reduction of groundwater overdraft is incorporated into every alternative via Reclamation's contracting principle that CVP water will not be allocated to expand irrigated agriculture in case of overdraft.

Allocate Remaining Yield to M&I Uses, Fish, and Wildlife

This alternative is very similar to Alternative 6, which gives percentages to a mix of refuge, M&I, and instream flow needs.

Allocate Remaining Yield to Fish, Wildlife, Riparian Habitat, and Recreation

This alternative is very similar to Alternative 5. Although Alternative 5 does not allocate yield for recreation, this allocation is made in Alternative 7.

Relocate East Bay Municipal Utility District's Point of Diversion from Folsom-South Canal (American River Service Area Alternative)

Reclamation has an existing contract with EBMUD which permits diversion of water from the American River using the Folsom-South Canal. EBMUD has been paying Reclamation in accordance with the contract provisions, and the analysis assumes that the contract will be honored. Reclamation's water contracting program recognizes EBMUD's right to divert 150,000 af/yr of American River water. However, the ARSA EIS includes an estimation of probable impacts to American River flows of changes in points of diversion of existing contractors such as EBMUD.

Allocate Remaining CVP Yield to Agricultural and M&I Needs within Authorized CVP Service Areas in Areas of Origin, and to American River Instream Flow Needs

This alternative combines components of several CVP-wide alternatives, including Alternatives 3, 5, and 6. The impacts of each component are analyzed in the EIS.

Allocate Remaining CVP Yield to Maintain the Most Viable and Economically Feasible Irrigated Lands, Located in the Delta Export Service Area

This alternative is very similar to Alternative 4C/D, in which all available firm and intermittent yield are allocated to the DESA.

Allocate Remaining Yield to Lands Currently Authorized by the Place of Use Identified in SWRCB Permits

This alternative is very similar to Alternative 2, in which available firm yield is allocated to constructed units where Reclamation's past water contracting programs have not been completed. The EIS impact analyses identify, for each alternative, those lands proposed for service that are outside the currently authorized place of use.

Allocate Remaining CVP Yield Consistent with Prior Reclamation Allocations

An alternative was suggested that would allocate the available supply to meet prior Reclamation allocations. This alternative included water for users in the DESA based on a feasibility investigation for the mid-Valley Canal in 1981. The purpose of this investigation was not to set forth binding allocations of remaining CVP yield. However, the allocations set forth in this investigation are similar to those of Alternative 4C/D.

SACRAMENTO RIVER SERVICE AREA WATER CONTRACTING ALTERNATIVES

Water Requests and Needs

As shown in Table 2-7, Reclamation received requests for new or expanded CVP water service contracts totaling 664,639 af/yr for agricultural, M&I, and refuge uses. The needs analysis resulted in a total SRSA need of 537,700 af/yr for these uses. Appendix II presents requests received by Reclamation from SRSA agencies, and their identified CVP water needs, and explains why requests were reduced, where appropriate. The needs analysis report is included as Technical Appendix A - Water Needs Analysis (Bound separately). Requesting agencies are shown in Figures 2-4, 2-5, and 2-6.

Additionally, Reclamation considered water needs for maintaining instream flows and reservoir levels in the SRSA for fisheries and recreational purposes. Specifically, instream flow needs were considered for the upper Sacramento River Clear Creek, and Trinity River. Shasta and Clair Engle Lakes were considered with respect to maintaining reservoir levels for recreational purposes. (See descriptions of Alternatives 5 and 7 below.)

Table 2-7. Water Requests and Needs for CVP Water:
Sacramento River Service Area

Agency	Principal Type of Use	Request (af/yr)	Need (af/yr)
Shasta Dam Area Public Utility District	M&I	6,000	4,800
<u>Sacramento Valley Canals Agencies</u>			
Colusa County Water District	Ag	55,000	55,000
Colusa Drain Mutual Water Company	Ag	20,000	0
Corning Water District	Ag	18,000	7,800
Dunnigan Water District	Ag	10,000	5,600
Glenn-Colusa Irrigation District	Ag	40,000	23,800
Glenn County Lands ^a	Ag	30,400	22,200
Glide Water District	Ag	16,345	10,700
Holthouse Water District	Ag	5,340	2,800
Orland-Artois Water District	Ag	40,000	36,700
Rancho Saucos Water District	Ag	4,000	4,000
Tehama Ranch Mutual Water Company	Ag	1,500	1,500
Yolo-Zamora Water District	Ag	<u>78,054</u>	<u>49,400^b</u>
Subtotal		318,639	219,500
<u>Yolo-Solano CVP Water Service Coordinating Group</u>			
Yolo County Flood Control and Water Conservation District	Ag	42,000	42,000
Davis, City of	M&I	9,200	9,200
Woodland, City of	M&I	11,800	11,800
Solano County ^c	M&I	<u>106,000</u>	<u>79,400</u>
Subtotal		169,000	142,400
<u>Refuges^d</u>			
Colusa National Wildlife Refuge	Refuge	25,000	25,000
Delevan National Wildlife Refuge	Refuge	30,000	30,000
Gray Lodge Wildlife Management Area	Refuge	36,000	36,000
Sacramento National Wildlife Refuge	Refuge	50,000	50,000
Sutter National Wildlife Refuge	Refuge	<u>30,000</u>	<u>30,000</u>
Subtotal		171,000	171,000
Subtotal Ag		360,639	261,500
Subtotal M&I		133,000	105,200
Subtotal Refuge		<u>171,000</u>	<u>171,000</u>
Total		664,639	537,700

^a Umbrella request for presently unorganized portions of Glenn County that could be annexed to and provided water service by Glide Water District, Kanawha Water District, Orland-Artois Water District, and Willow Creek Mutual Water Company.

^b Current Reclamation estimate of needs is 19,600 instead of 49,400.

^c Umbrella request for Cities of Benecia, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo; Solano Irrigation District; and Solano County Flood Control and Water Conservation District.

^d Level 4 needs shown. Level 2 needs equal 25,000, 21,000, 27,400, 46,400, and 23,500, respectively.

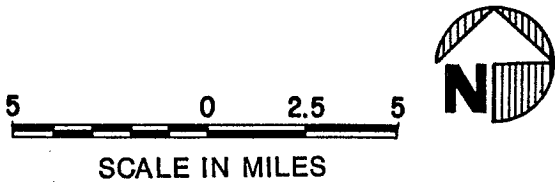
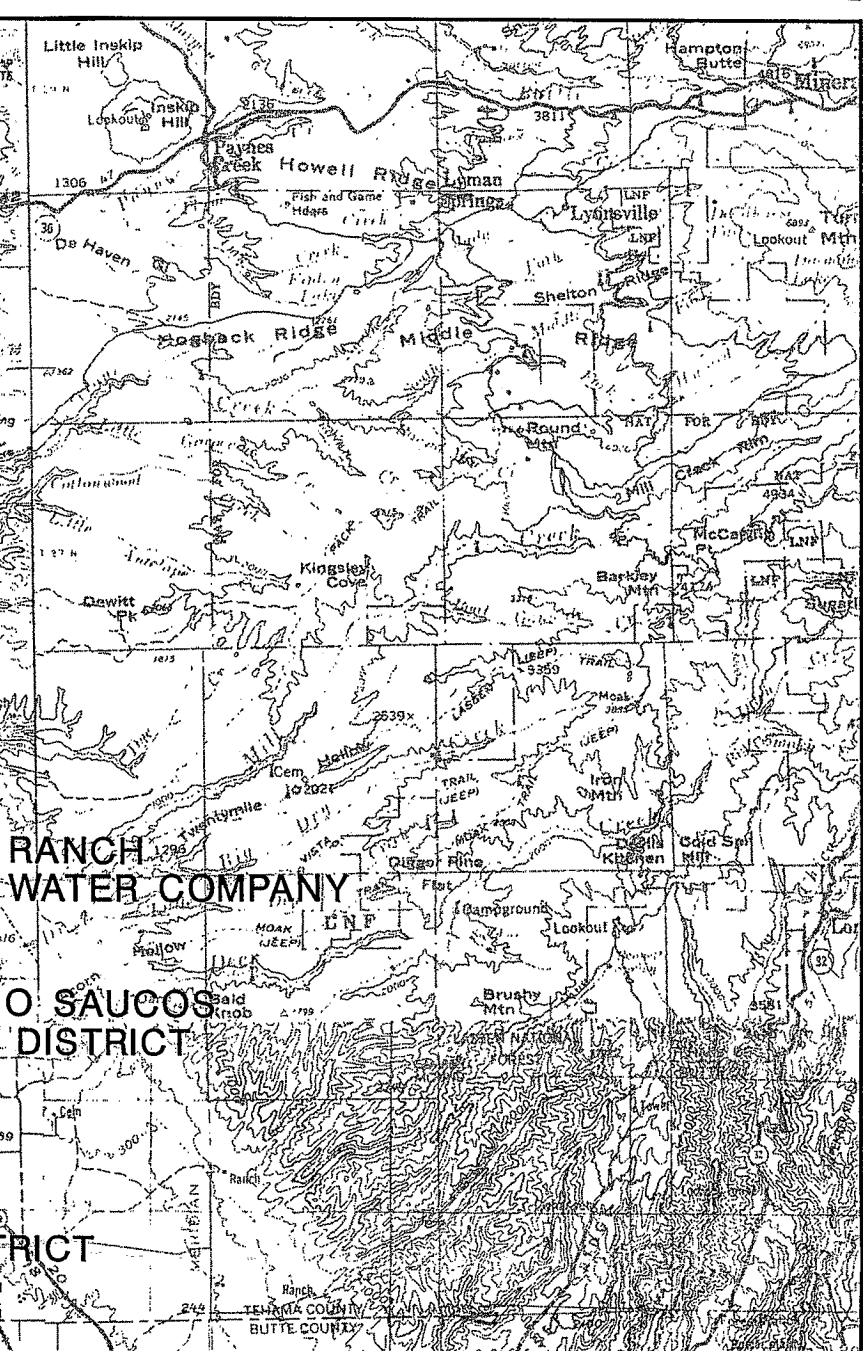
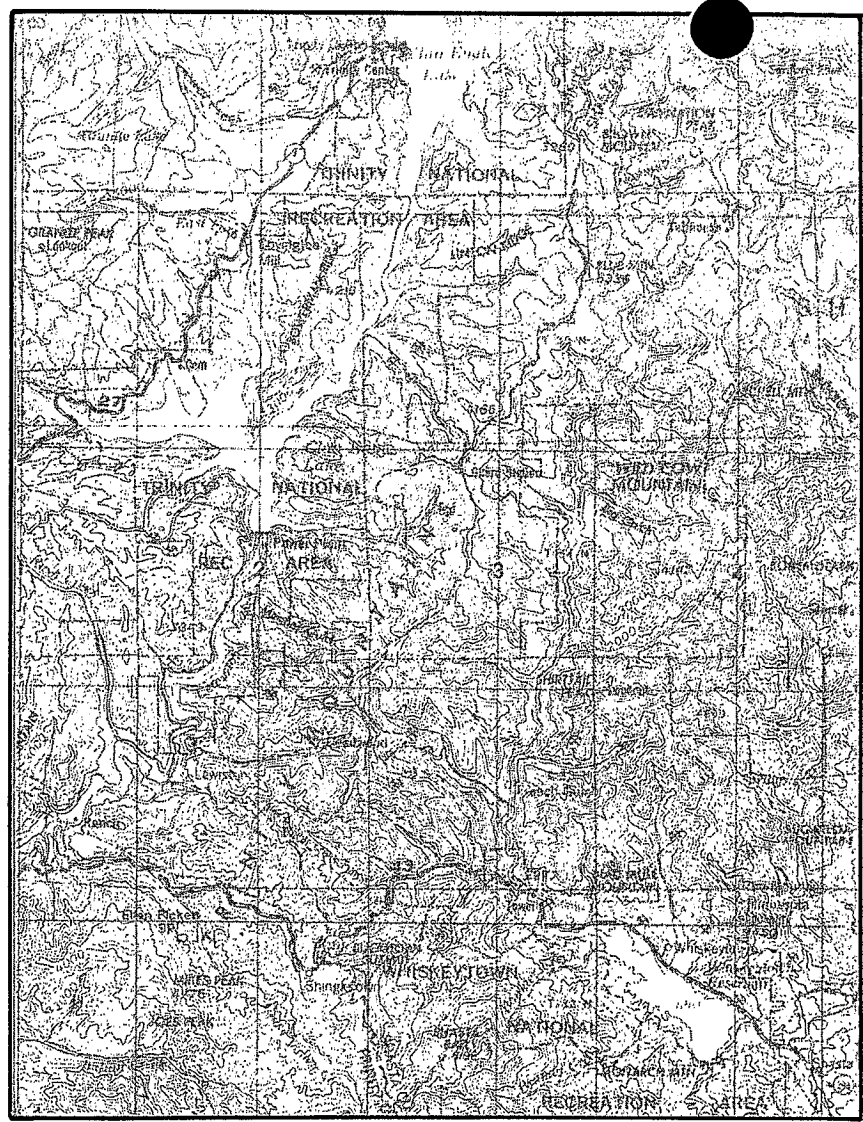
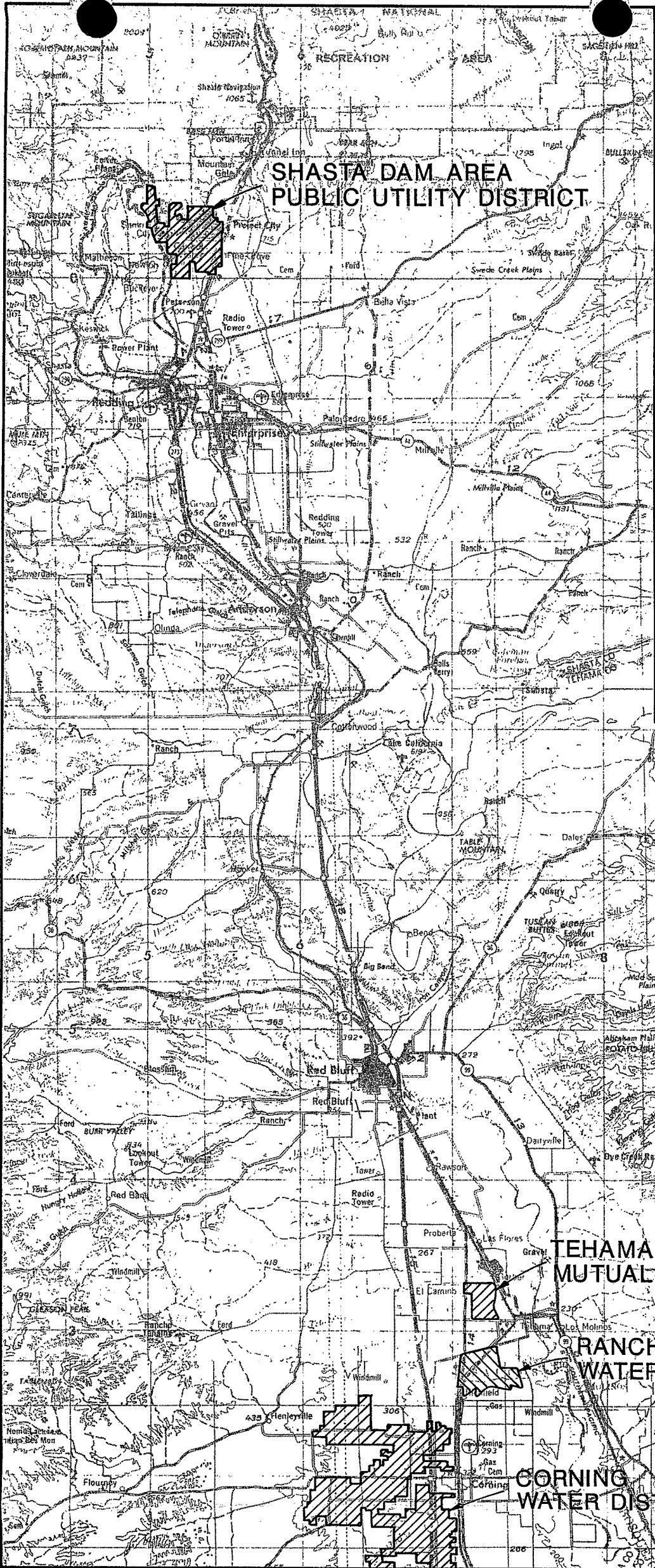
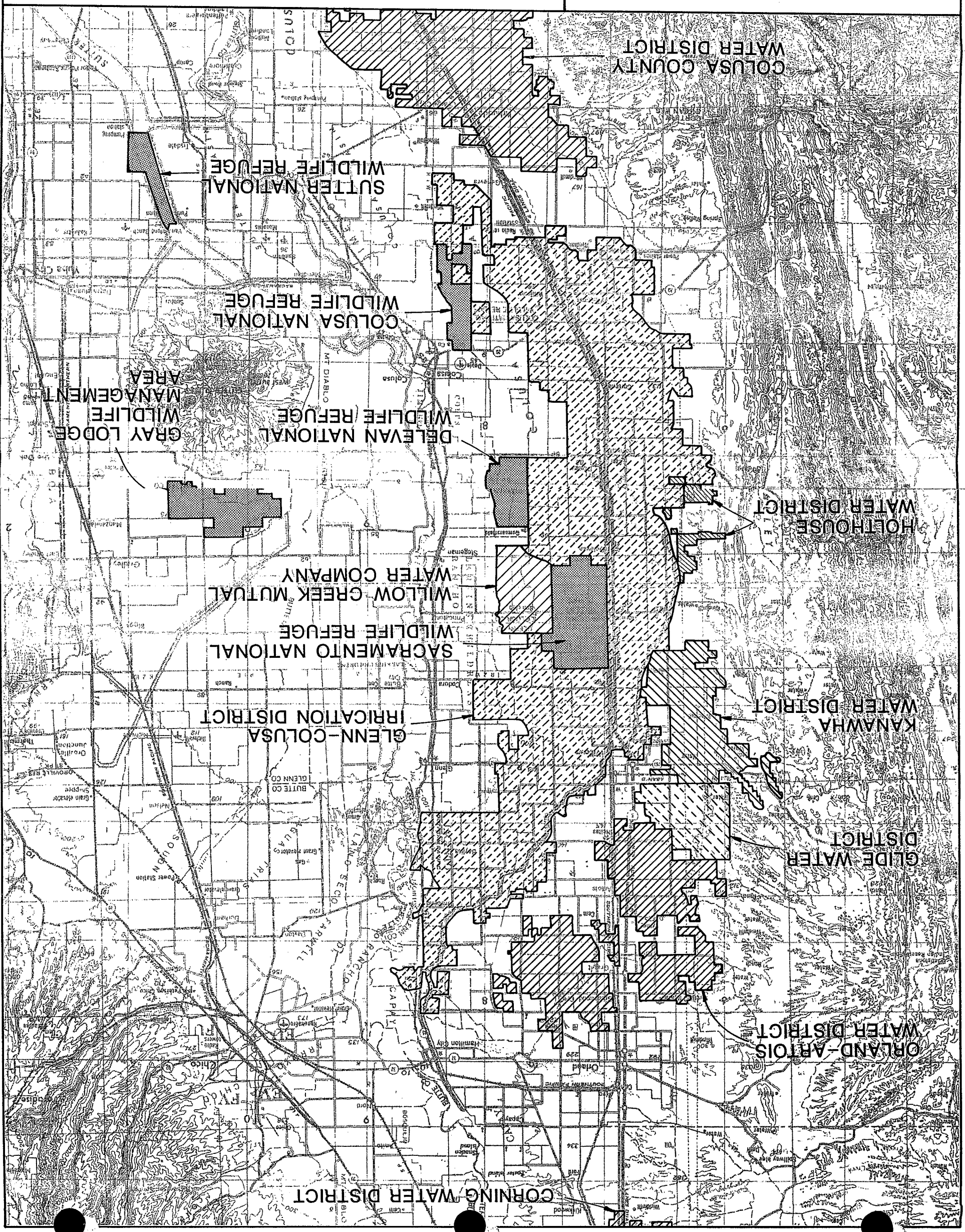
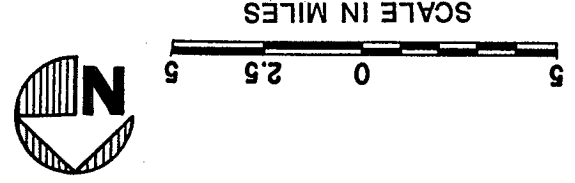


FIGURE 2-4.
REQUESTING AGENCIES
SACRAMENTO RIVER SERVICE AREA

FIGURE 2-5.
REQUESTING AGENCIES
SACRAMENTO RIVER SERVICE AREA



2-33

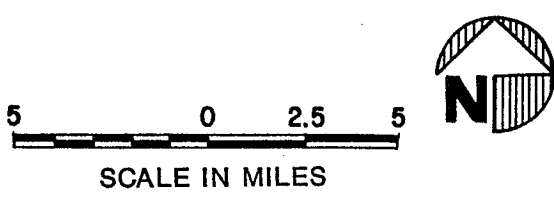
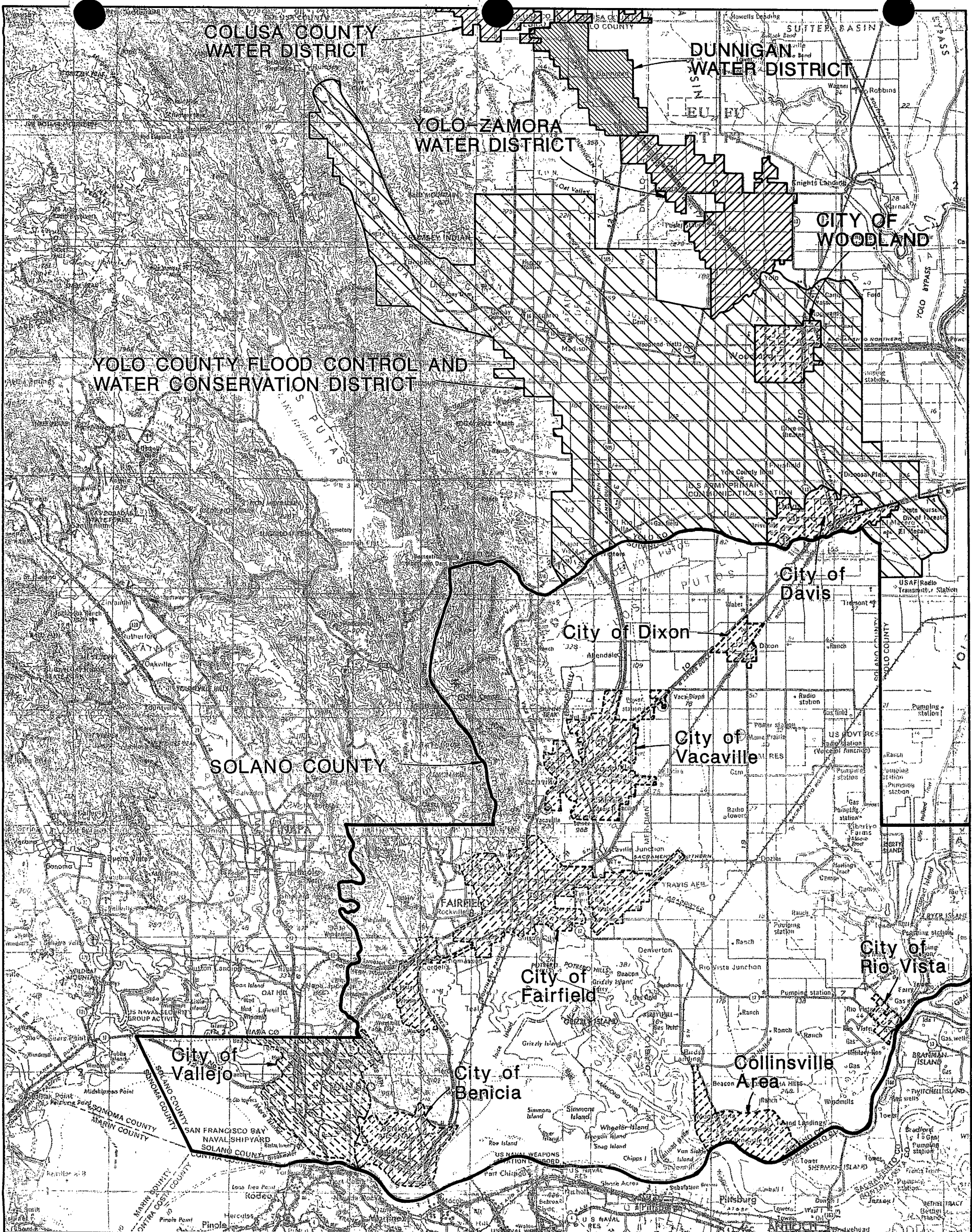


FIGURE 2-6.

REQUESTING AGENCIES

SACRAMENTO RIVER SERVICE AREA

No-Action Alternative

Under the No-Action Alternative, no new long-term contracts would be signed with agencies in the SRSA. Although no new contracts would be executed, water deliveries in the SRSA would expand modestly from present (1985) levels as existing firm yield contractors reach their contract maximums and contracts are renewed following expiration. As shown in Table 2-2, 2020 deliveries are assumed to be 3,138,200 af/yr, an increase of 45,800 af from the 1985 deliveries of 3,092,400 af/yr. These deliveries reflect a general increase in agricultural and M&I deliveries amounting to 105,800 af/yr and a reduction in interim water deliveries to refuges of 60,000 af/yr.

If no additional CVP water contracts are signed, it is assumed that some SRSA needs would be met from groundwater pumping and that other needs would not be met because of the lack of a feasible alternative supply. New surface water projects are not assumed under the No-Action Alternative. The non-CVP alternative supplies assumed for each agency under the No-Action Alternative are shown in Table 2-8. The basis for these assumptions is as follows:

- o The needs of Shasta Dam Area Public Utility District are assumed not to be met due to the lack of available groundwater in that area and the economic infeasibility of alternative surface water projects.
- o It is assumed that agricultural needs associated with existing lands, which are now met with temporary surface water contracts, groundwater, or both, would be met with pumped groundwater through at least 2020 (No assumption is made for the adequacy of groundwater supplies to support irrigation of existing lands beyond 2020, since this is beyond the EIS time frame for analysis.) In contrast, it is assumed that development of presently unirrigated land would occur only with the provision of CVP water; thus, without CVP water, the potential needs of these presently undeveloped lands would not be met.
- o The Colusa County Water District represents a special case in that it includes approximately 11,000 acres of land that may be currently irrigated but are principally dry-farmed for grain production. Full irrigation of these lands is assumed to require an additional 35,000 af/yr of water. It is assumed that these needs, as well as the 3,500-af need of new lands, would not be met. The remaining 16,000 af needed for the maintenance of existing intensively irrigated lands would be met with groundwater.
- o The M&I needs of the Yolo-Solano CVP Water Service Coordinating Group are assumed to be met with groundwater. In addition, it may be possible to increase the yield from Lake Berryessa through modified operation and conjunctive groundwater use; however, the feasibility of such an operation is as yet undetermined.
- o Finally, it is assumed that refuge water needs would not be met in the absence of a federal groundwater development program.

Table 2-8. Requesting Agency Other Water Supplies:
Sacramento River Service Area

Agency	Use Type	CVP Water Need			Surface Water		Other Supply		Not Met		Comments
		Existing Lands (af)	New Lands (af)	Total (af)	Amount (af)	Percent of Need	Groundwater Amount (af)	Percent of Need	Amount (af)	Percent of Need	
Shasta Dam Area Public Utility District	M&I	NA	NA	4,800	0	0	0	0	4,800	100	Needs not met because of lack of available groundwater.
<u>Sacramento Valley Canals Agencies</u>											
Colusa County ^a	Ag	51,500	3,500	55,000	0	0	16,100	29	38,900	71	Needs of developed lands met from groundwater; needs of new lands not met.
Corning Water District	Ag	0	7,800	7,800	0	0	0	0	7,800	100	It is assumed that new lands would not be developed without CVP water; therefore, needs not met.
Dunnigan Water District	Ag	0	5,600	5,600	0	0	0	0	5,600	100	Needs of developed lands met from groundwater; needs of new lands not met.
Glenn-Colusa Irrigation District	Ag	14,300	9,500	23,800	0	0	14,300	60	9,500	40	Needs of developed lands met from groundwater; needs of new lands not met.
<u>Glenn County Lands</u>											
Glide Water District	Ag	0	2,000	2,000	0	0	0	0	2,000	100	It is assumed that new lands would not be developed without CVP water; therefore, needs not met.
Kanawha Water District	Ag	0	9,200	9,200	0	0	0	0	9,200	100	It is assumed that new lands would not be developed without CVP water; therefore, needs not met.
Orland-Artois Water District	Ag	0	9,500	9,500	0	0	0	0	9,500	100	It is assumed that new lands would not be developed without CVP water; therefore, needs not met.
Willow Creek Mutual Water Company	Ag	0	1,500	1,500	0	0	0	0	1,500	100	It is assumed that new lands would not be developed without CVP water; therefore, needs not met.
Glide Water District	Ag	2,400	8,300	10,700	0	0	2,400	22	8,300	78	Needs of developed lands met from groundwater; needs of new lands not met.
Holthouse Water District	Ag	0	2,800	2,800	0	0	0	0	2,800	100	It is assumed that new lands would not be developed without CVP water; therefore, needs not met.
Orland-Artois Water District	Ag	12,500	24,200	36,700	0	0	12,500	34	24,200	66	Needs of developed lands met from groundwater; needs of new lands not met.
Rancho Saucos Water District	Ag	4,000	0	4,000	0	0	4,000	100	0	0	All lands are presently developed, and it is assumed that needs would continue to be met from groundwater.

Table 2-8. Continued

Agency	Use Type	CVP Water Need			Surface Water		Other Supply		Not Met		Comments
		Existing Lands (af)	New Lands (af)	Total (af)	Amount (af)	Percent of Need	Groundwater Amount (af)	Percent of Need	Amount (af)	Percent of Need	
Tehama Ranch Mutual Water Company	Ag	1,500	0	1,500	0	0	1,500	100	0	0	All lands are presently developed, and it is assumed that needs would continue to be met from groundwater.
Yolo-Zamora Water District	Ag	<u>30,000</u>	<u>19,400</u>	<u>49,400</u>	<u>0</u>	0	<u>30,000</u>	61	<u>19,400</u>	39	Needs of developed lands met from groundwater; needs of new lands not met.
Subtotal		116,200	103,300	219,500	0	0	80,800	37	138,700	63	
<u>Yolo-Solano CVP Water Service Coordinating Group</u>											
Yolo County Flood Control and Water Conservation District	Ag	32,900	9,100	42,000	0	0	32,900	78	9,100	22	Needs of developed lands met from groundwater; needs of new lands not met.
Davis, City of	M&I	NA	NA	9,200	0	0	9,200	100	0	0	Needs met from groundwater.
Woodland, City of	M&I	NA	NA	11,800	0	0	11,800	100	0	0	Needs met from groundwater.
Solano County	M&I	<u>NA</u>	<u>NA</u>	<u>79,400</u>	<u>0</u>	0	<u>79,400</u>	100	<u>0</u>	0	Needs met from groundwater.
Subtotal		32,900	9,100	142,400	0	0	133,300	94	9,100	6	
<u>Refuges</u>											
Colusa National Wildlife Refuge	Refuge	NA	NA	25,000	0	0	0	0	25,000	100	Needs not met in absence of federal groundwater development program.
Delevan National Wildlife Refuge	Refuge	NA	NA	30,000	0	0	0	0	30,000	100	Needs not met in absence of federal groundwater development program.
Gray Lodge Wildlife Management Area	Refuge	NA	NA	36,000	0	0	0	0	36,000	100	Needs not met in absence of federal groundwater development program.
Sacramento National Wildlife Refuge	Refuge	NA	NA	50,000	0	0	0	0	50,000	100	Needs not met in absence of federal groundwater development program.
Sutter National Wildlife Refuge	Refuge	NA	NA	<u>30,000</u>	<u>0</u>	0	<u>0</u>	0	<u>30,000</u>	100	Needs not met in absence of federal groundwater development program.
Subtotal				171,000	0	0	0	0	171,000	100	
Total		149,100	112,400	537,700	0	0	214,100	39	323,600	60	

^a Much of Colusa County Water District's need associated with existing lands is to convert from occasionally irrigated grain production to intensive irrigated farming. It is assumed that this conversion would not occur without CVP water; therefore, these needs would not be met.

Alternative 1 - Dependable Supply Contracting

Alternative 1 has two options differing from traditional firm yield contracting in the degree of emphasis placed on dependable supply contracting. Under both options, interim water would be supplied for up to 10 years to provide a firm yield supply until alternative dry-year supplies are developed. Table 2-9 shows allocations under both options.

To implement the dependable supply contracting required by either option, two operational strategies exist, one having a district-level perspective and the other a regional perspective. Both strategies achieve long-term safe yield groundwater operation but have different costs.

Implemented at the district level, fully utilizing intermittent water requires having a dual system capable of supplying full needs from either groundwater or surface water. In wet years, full needs would be met from surface supplies, and no groundwater would be pumped, in essence increasing groundwater storage. In dry years, all or a portion of needs would be met from groundwater pumping. The primary disadvantage of dual systems is that both the surface water and groundwater systems must be sized to deliver full water needs, resulting in large, less frequently utilized system capacities and associated higher costs.

Using intermittent water on a regional basis would require further planning studies prior to implementation. This concept involves well-field or dispersed well development and/or artificial recharge in areas where groundwater basin characteristics are suitable. In effect, these basins would be operated like surface reservoirs, with surplus water stored underground during wet years for use in dry years. Water pumped from the well field would be diverted into regional conveyance facilities, along with available surface water, to provide a firm supply to requestors.

With such a regional approach, district-level treatment and distribution facilities would be sized for less capacity, with lower costs than dual systems. District-level groundwater pumping would be fairly uniform at safe yield levels, also requiring less capacity. Furthermore, it may be possible to locate well fields strategically with respect to conveyance facilities so that either best use is made of existing capacity or the capacity of new facilities can be reduced. Conveyance capacity that is normally unutilized during off-peak water use periods would be utilized to convey intermittent water to artificial recharge basins. In addition to recharge basins, reregulation storage would be required to deliver water at the time and place needed.

Costs associated with intermittent water include construction and operation of the recharge and reregulation storage facilities; wells, pumps, and piping associated with recovery of the stored water; and an increased capacity increment at M&I water treatment facilities. A rough estimate of construction costs for these increased capacity increment elements is \$90 million, with annual operation and maintenance costs of \$1 million.

Table 2-9. Requesting Agency Water Allocations:
Sacramento River Service Area

Agency	Use Type	Additional CVP Water Need	1A			1B			2		3		4A/B		4C/D		5		6		7	
			CVP Water Allocation		% of Need	CVP Water Allocation		% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need
Shasta Dam Area Public Utility District	M&I	4,800	4,800	0	100	4,800	0	100	4,800	100	4,800	100	4,800	100	0	0	0	0	4,800	100	0	0
<u>Sacramento Valley Canals Agencies</u>																						
Colusa County WD	Ag	55,000	42,000	13,000	100	32,900	22,100	100	42,000	76	55,000	100	42,000	76	0	0	0	0	42,000	76	0	0
Corning WD	Ag	7,800	7,800	0	100	7,808	0	100	7,800	100	7,800	100	7,800	100	0	0	0	0	7,800	100	0	0
Dunnigan WD	Ag	5,600	4,300	1,300	100	5,200	400	100	4,300	76	5,600	100	4,300	76	0	0	0	0	4,300	76	0	0
Glenn-Colusa ID	Ag	23,800	23,800	0	100	0	23,800	100	23,800	100	23,800	100	23,800	100	0	0	0	0	23,800	100	0	0
Glenn County																						
Glide WD	Ag	2,000	1,500	500	100	0	2,000	100	1,500	76	2,000	100	1,500	76	0	0	0	0	1,500	76	0	0
Kanawha WD	Ag	9,200	7,000	2,200	100	0	9,200	100	7,000	76	9,200	100	7,000	76	0	0	0	0	7,000	76	0	0
Orland-Artois WD	Ag	9,500	7,300	2,200	100	10	9,500	100	7,300	76	9,500	100	7,300	76	0	0	0	0	7,300	76	0	0
Willow Creek MWCo.	Ag	1,500	1,200	300	100	0	1,500	100	1,200	76	1,500	100	1,200	76	0	0	0	0	1,200	76	0	0
Glide WD	Ag	10,700	8,200	2,500	100	2,000	8,700	100	8,200	76	10,700	100	8,200	76	0	0	0	0	8,200	76	0	0
Holthouse WD	Ag	2,800	2,100	700	100	1,800	1,000	100	2,100	76	2,800	100	2,100	76	0	0	0	0	2,100	76	0	0
Orland-Artois WD	Ag	36,700	27,900	8,800	100	8,700	28,000	100	27,900	76	36,700	100	27,900	76	0	0	0	0	27,900	76	0	0
Rancho Saucos WD	Ag	4,000	3,100	900	100	1,700	2,300	100	3,100	76	43,000	100	3,100	76	0	0	0	0	3,100	76	0	0
Tehama Ranch MWCo.	Ag	1,500	1,200	300	100	300	2,400	100	1,200	76	1,500	100	1,200	76	0	0	0	0	1,200	76	0	0
Yolo-Zamora WD	Ag	49,400 ^d	37,700	11,700	100	15,000	34,400	100	37,700	76	49,400	100	37,700	76	0	0	0	0	37,700	76	0	0
Subtotal		219,500	175,100	44,400	100	75,200	144,300	100	175,100	80	219,500	100	175,100	80	0	0	0	0	175,100	80	0	0
<u>Yolo-Solano CVP Water Service Coord. Group</u>																						
Yolo County FC&WCD	Ag	42,000	0	42,000	100	0	42,000	100	0	0	42,000	100	0	0	0	0	0	0	0	0	0	0
Davis, City of	M&I	9,200	0	9,200	100	0	9,200	100	0	0	9,200	100	0	0	0	0	0	0	0	0	0	0
Woodland, City of	M&I	11,800	0	11,800	100	0	11,800	100	0	0	11,800	100	0	0	0	0	0	0	0	0	0	0
Solano County	M&I	79,400	0	79,400	100	0	79,400	100	0	0	79,400	100	0	0	0	0	0	0	0	0	0	0
Subtotal		142,400	0	142,400	100	0	142,400	100	0	0	142,400	100	0	0	0	0	0	0	0	0	0	0

Table 2-9. Continued

Agency	Use Type	Addi- tional CVP Water Need	1A			1B			2		3		4A/B		4C/D		5		6		7	
			CVP Water Allocation		% of Need	CVP Water Allocation		% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need	CVP Water Allocation	% of Need
			Firm	Intermt		Firm	Intermt															
<u>Refuges</u>																						
Colusa NWR	Refuge	25,000 ^a	0	25,000	100 ^b	0	25,000	100 ^b	0	0	25,000 ^c	100 ^b	25,000 ^c	100	25,000 ^c	100 ^b	25,000	100	25,000	100 ^b	25,000 ^c	100
Delevan NWR	Refuge	30,000 ^a	0	21,000	100 ^b	0	30,000	100 ^b	0	0	21,000 ^c	100 ^b	30,000 ^c	100	21,000 ^c	100 ^b	30,000	100	21,000	100 ^b	30,000 ^c	100
Gray Lodge WMA	Refuge	36,000 ^a	0	27,400	100 ^b	0	36,000	100 ^b	0	0	27,400 ^c	100 ^b	36,000 ^c	100	27,400 ^c	100 ^b	36,000	100	27,400	100 ^b	36,000 ^c	100
Sacramento NWR	Refuge	50,000 ^a	0	46,400	100 ^b	0	50,000	100 ^b	0	0	46,400 ^c	100 ^b	50,000 ^c	100	46,400 ^c	100 ^b	50,000	100	46,400	100 ^b	50,000 ^c	100
Sutter NWR	Refuge	30,000 ^a	0	23,500	100 ^b	0	30,000	100 ^b	0	0	23,500 ^c	100 ^b	30,000 ^c	100	23,500 ^c	100 ^b	30,000	100	23,500	100 ^b	30,000 ^c	100
Subtotal		171,000	0	143,300	100 ^b	0	171,000	100	0	0	143,300 ^c	100 ^b	171,000 ^c	100	143,000 ^c	100	171,000	100	143,500	100 ^b	171,000 ^c	100
Total		537,700	179,900	330,100	100	80,000	457,700	100	179,900	33	510,000	100	350,900	69	143,300 ^c	28	171,000	32	232,200	63	171,000 ^c	32
Proposed Action Total				510,000			537,700															

Note: The No-Action Alternative, under which there would be no new CVP water service contracting, is not shown on this table.

^a Level 4 needs shown; Level 2 needs are:

Colusa NWR:	25,000 af/yr
Delevan NWR:	21,000 af/yr
Gray Lodge WMA:	27,400 af/yr
Sacramento NWR:	46,400 af/yr
Sutter NWR:	23,500 af/yr

^b Percentage is of level 2 needs.

^c Denotes intermittent water.

^d Current Reclamation estimate of needs is 19,600 instead of 49,400. Allocations in the Final EIS will reflect this lower estimate.

Option 1A

Under Option 1A, a total of about 180,000 af/yr of firm yield water would be contracted to requestors in constructed units. This includes 4,800 af/yr to Shasta Dam Area Public Utility District and 175,000 af/yr for requestors in the Sacramento Valley Canals Unit.

Remaining needs of requestors served by the Tehama-Colusa Canal, needs of refuges (Level 2), and the Yolo-Solano CVP Water Service Coordinating Group plus use of groundwater would be met with intermittent water under dependable supply contracting. Intermittent water deliveries would meet 330,100 af/yr of needs on a firm yield basis. Intermittent water deliveries would vary significantly from year to year, depending on availability. The amounts that would be available for the different types of hydrologic years are defined in Table 2-8.

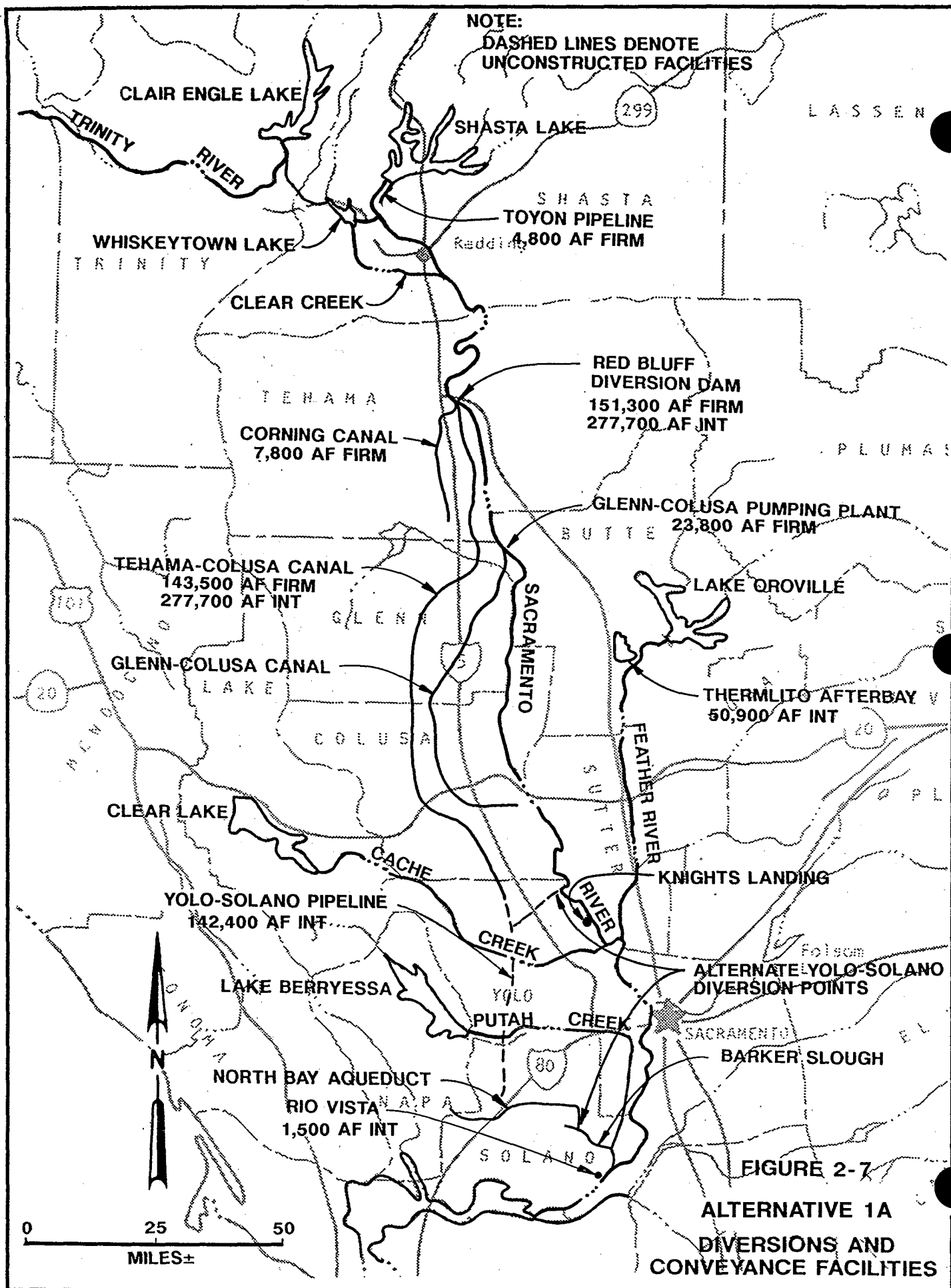
In the Yolo-Solano service area, intermittent water could be used in conjunction with available groundwater or non-CVP supplied water to satisfy needs using dual systems. Groundwater pumping would be reduced in years when intermittent water is available and increased in years when it is not. Intermittent water could be delivered in one or more alternative ways. These include taking water delivery from the end of the Tehama-Colusa Canal (requiring construction of Sites Reservoir and increasing capacity of Tehama-Colusa Canal); from the Sacramento River near El Dorado Bend, northwest of Knights Landing, conveying it southward through Yolo County to Solano County (making deliveries to the Cities of Woodland and Davis and to agricultural users along the way); or from the DWR North Bay Aqueduct (subject to available capacity) to meet the Solano Project contractual commitments, with a corresponding transfer of Lake Berryessa water northward to meet Yolo County needs. The North Bay Aqueduct capacity could also be used in conjunction with the Tehama-Colusa Canal or the Sacramento River as previously described. The river diversion and conveyance facilities associated with Option 1A are shown on Figure 2-7.

To fully satisfy refuge needs, intermittent water would have to be used in conjunction with groundwater or temporary onsite storage. Such use may require some off-refuge well-field development, since on-refuge groundwater availability relative to water needs is limited at some refuges (see "Groundwater" section of Chapter 4).

Option 1B

Under Option 1B, a total of about 80,000 af/yr of firm yield water would be contracted in the SRSA. This includes 4,800 af/yr to Shasta Dam Area Public Utility District and up to 75,000 af/yr to agricultural requestors in the Sacramento Valley Canals Unit whose available groundwater does not lend itself to intermittent operation.

The remaining needs of requestors serviced by the Tehama-Colusa Canal, refuges, and the Yolo-Solano CVP Water Service Coordinating Group would be met with intermittent water, as described under Option A, except that Level 4, rather than Level 2, refuge needs would be met.



Intermittent water deliveries and groundwater would meet 457,700 af/yr of needs on a firm yield basis. Intermittent water deliveries would vary significantly from year to year. The amounts that would be available for the different types of hydrologic years are defined in Table 2-5. The river diversion and conveyance facilities associated with this alternative are shown in Figure 2-8.

Alternative 2 - Agricultural and M&I Needs Within Constructed CVP Units

Under Alternative 2, new or expanded water service contracts would be signed with requestors in the constructed portion of the Sacramento Canals Unit, where Reclamation's past contracting program has not been completed. As shown in Table 2-9, firm water would be contracted to selected agricultural and M&I requestors.

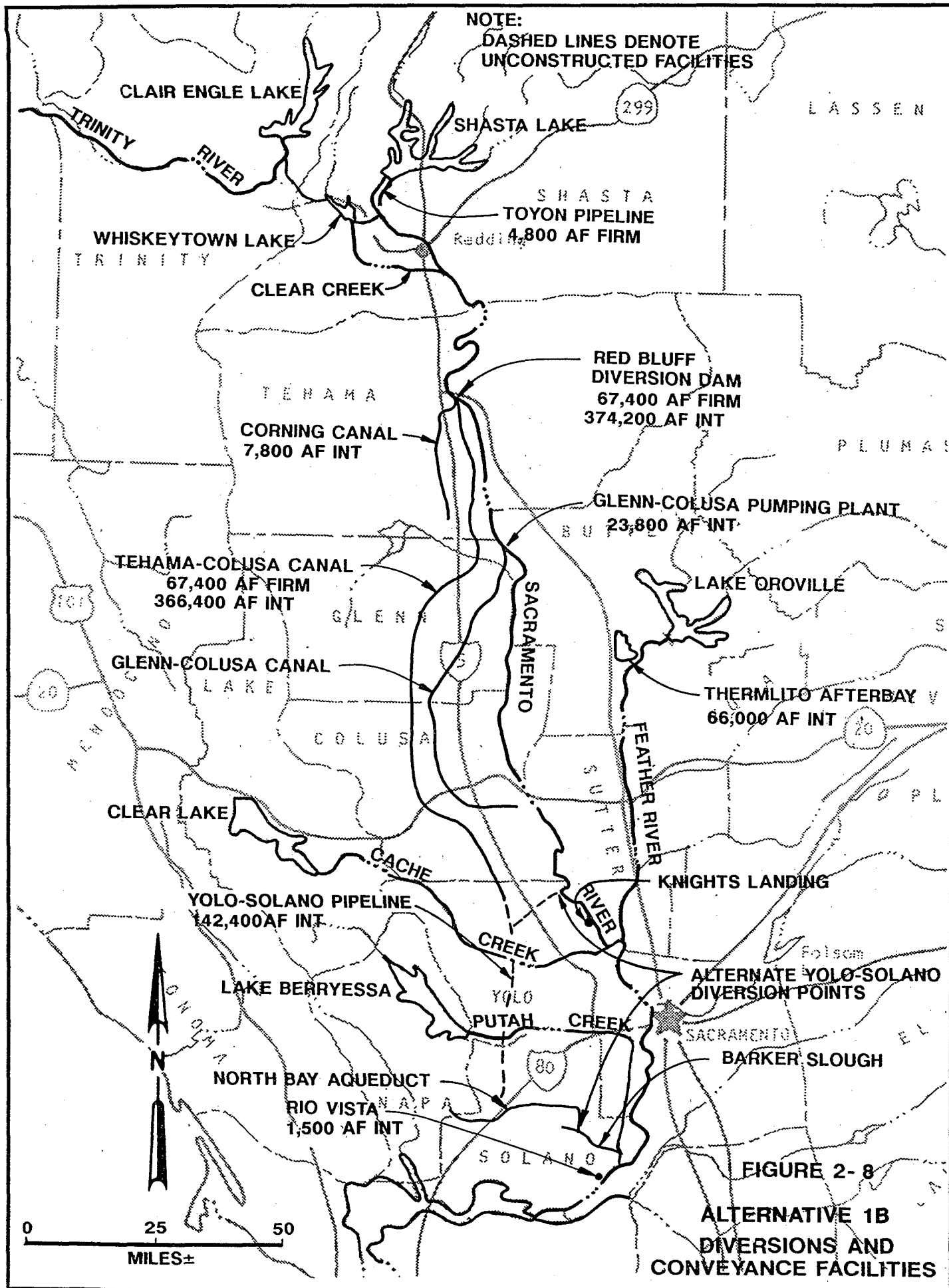
A total of 175,100 af/yr would be contracted to requestors served by the Corning and Tehama-Colusa canals, providing 80 percent of the needed water. Available capacity in the Corning Canal would be adequate for delivering the entire amount needed. However, available capacity in the Tehama-Colusa Canal, without construction of regulating storage facilities, would be adequate for delivering only 76 percent of the water needs. Water would therefore be allocated equally (on a percentage of need basis) to all requestors receiving water from the Tehama-Colusa Canal under this alternative. The Yolo County Flood Control and Water Conservation District is not within a constructed unit and therefore would not be allocated water under this alternative.

Of the M&I requestors, only the Shasta Dam Area Public Utility District would be allocated its full need (4,800 af). No allocations would be made to M&I needs in Davis, Woodland, or Solano County, because these areas are not within constructed units.

The river diversions and conveyance facilities associated with Alternative 2 are shown on Figure 2-9. The majority of the contracted water would be diverted from the Sacramento River at the Red Bluff Diversion Dam and conveyed to contractors either by the Corning or Tehama-Colusa Canals. Additionally, some water would be diverted from the Sacramento River into the Glenn-Colusa Canal, near Hamilton City. Shasta Dam Area Public Utility District would draw its water directly from Shasta Lake via the Toyon pipeline.

Alternative 3 - Agricultural and M&I Needs in Areas of Origin

Under Alternative 3, new or expanded CVP water service contracts would be signed to provide the entire needs of agricultural and M&I requestors in the SRSA, plus the Level 2 needs of refuges. As shown in Table 2-9, agricultural and M&I needs, 261,500 and 105,200 af/yr respectively, would be provided on a firm basis, whereas refuge Level 2 supplies (143,300 af/yr) would be provided on an intermittent basis. The refuges' intermittent supplies would be used in conjunction with available groundwater, in effect providing a firm supply.



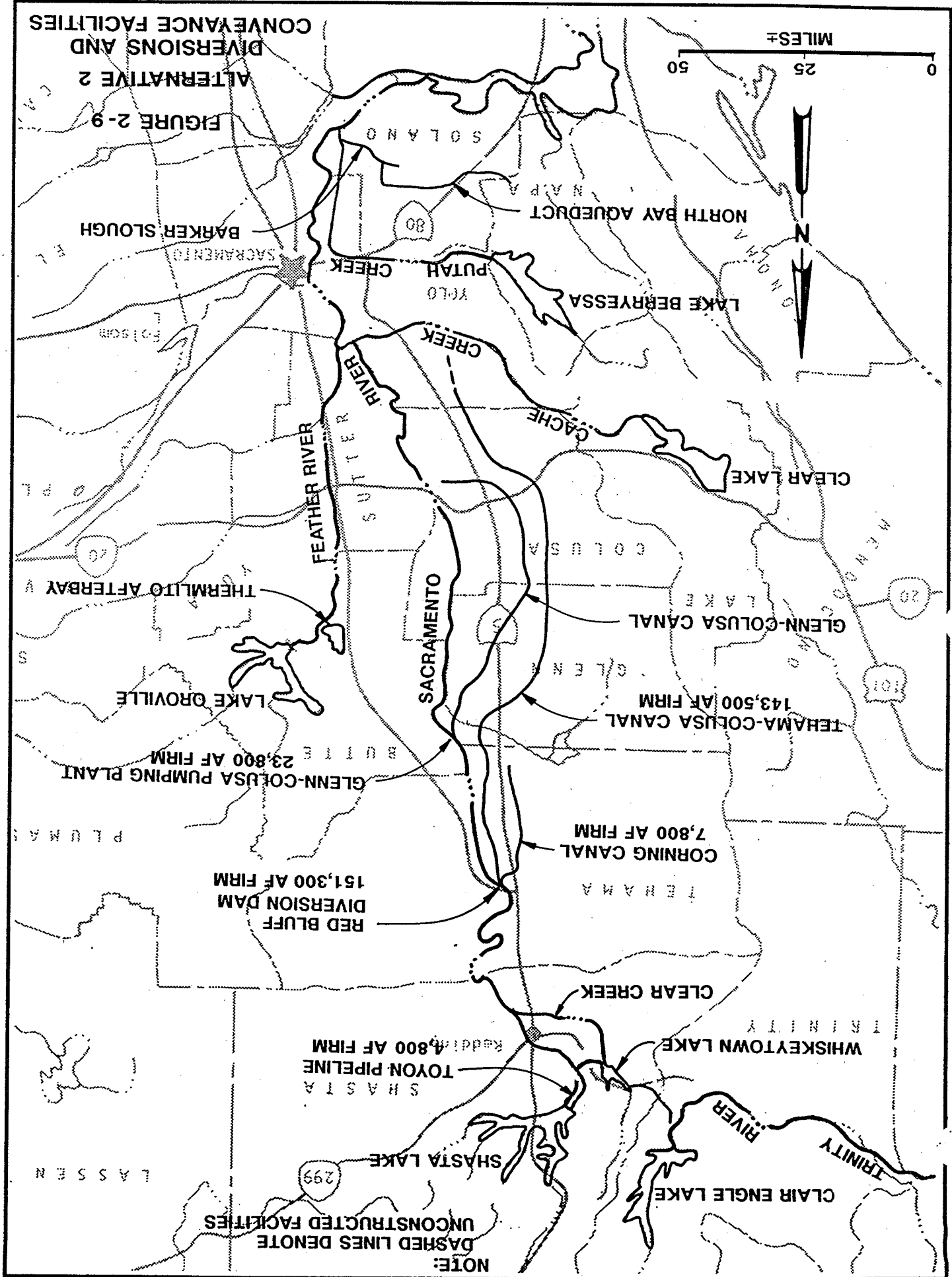


FIGURE 2-9
ALTERNATIVE 2
DIVERSIONS AND
CONVEYANCE FACILITIES

2-43

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The delivery of water allocated under this alternative would require modification of existing water conveyance facilities and construction of new facilities. The capacity of the existing portions of Tehama-Colusa Canal would have to be enlarged, the canal would need to be lengthened, and regulating storage would need to be added. Delivery of CVP water to Yolo and Solano County requestors is assumed to require the construction of a major pipeline system from the end of the Tehama-Colusa Canal. The same diversion points discussed under Alternative 2 would be used under Alternative 3; however, the diversion quantities would be different. Figure 2-10 shows the river diversion and conveyance facilities associated with this alternative.

Alternative 4A/B - Agricultural and M&I Needs in the DESA

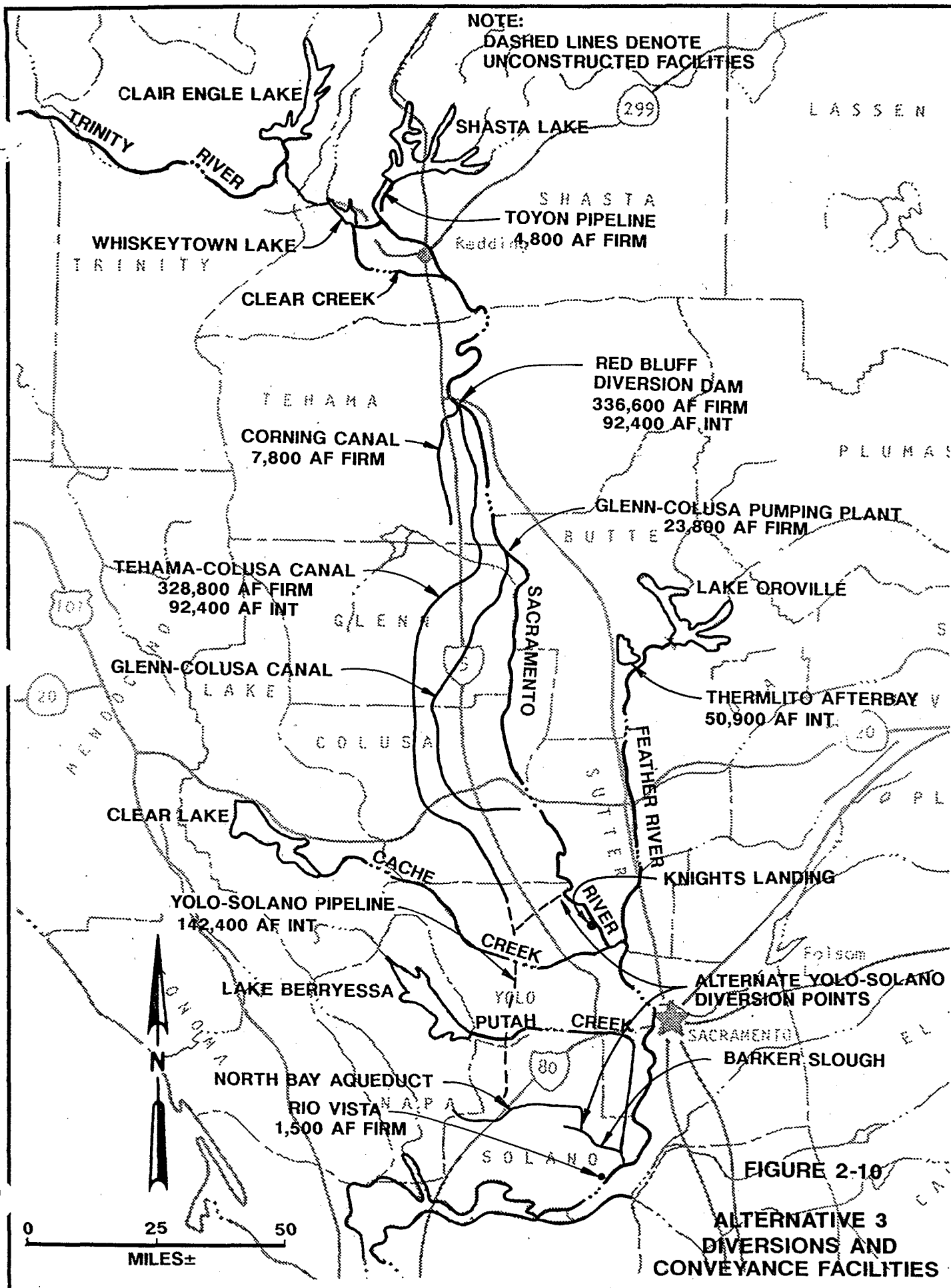
Alternative 4A/B emphasizes allocations to agricultural and M&I requestors in the DESA. Four subalternatives allocate this water in various ways within the DESA, including Alternative 4A/B, which would allocate water limited to available capacities in existing Delta export pumping and conveyance facilities, with remaining CVP yield allocated to requestors in constructed units in the SRSA and ARSA. Allocations, diversions, and conveyance facilities in the SRSA associated with Alternative 4A/B would be identical to those discussed under Alternative 2, as shown in Table 2-9. In addition, intermittent water would be allocated to meet refuge needs (Level 4). River diversion and conveyance facilities associated with this alternative are shown in Figure 2-11.

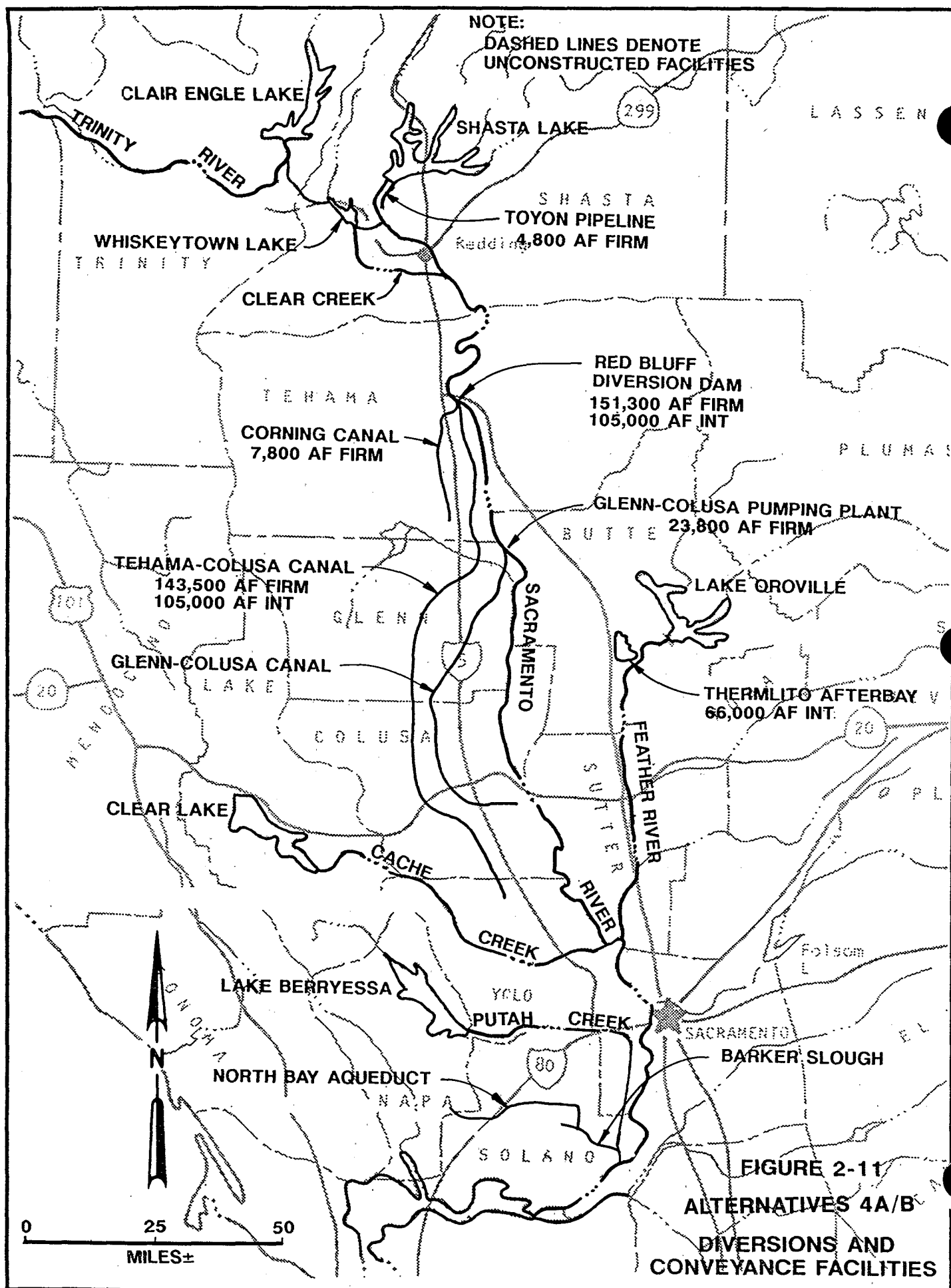
Alternative 4C/D - Agricultural and M&I Needs in the DESA

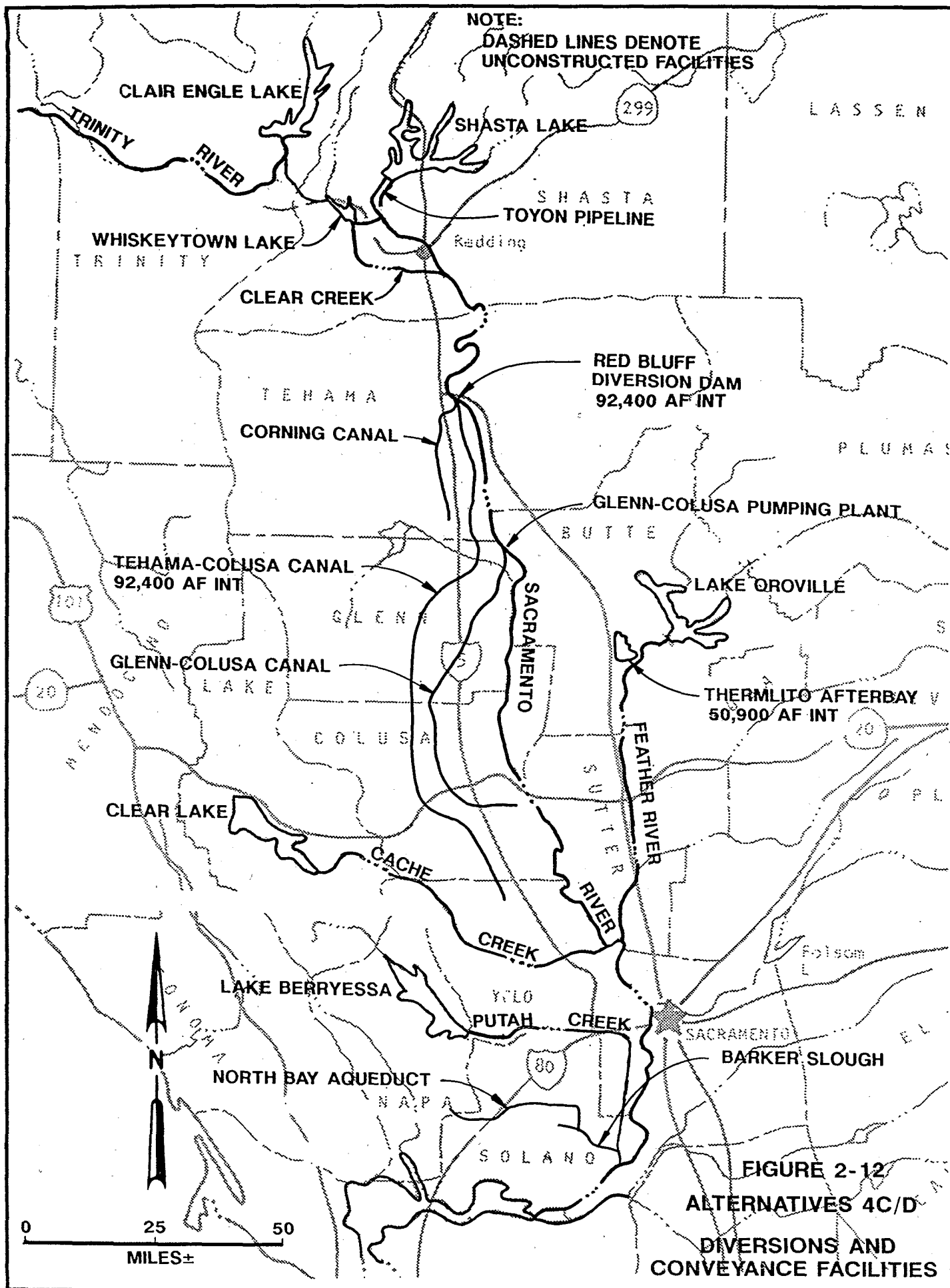
Alternative 4C/D also emphasizes allocations to agricultural and M&I requestors in the DESA. Alternative 4C/D would allocate all available firm yield irrespective of existing Delta export pumping and conveyance capacities. Under this alternative, the only water contracted in the SRSA would be intermittent supplies to the refuges (Level 2 needs). No water would be allocated to SRSA agricultural or M&I requestors. Figure 2-12 shows the river diversion and conveyance facilities associated with this alternative.

Alternative 5 - Refuge and Instream Flow Needs

Alternative 5 gives preference to maintenance and enhancement of Central Valley fish and wildlife resources. In the SRSA, Level 4 needs (171,000 af/yr) for the five refuges would be met on a firm basis, as shown in Table 2-9. Available remaining yield would be committed to maintaining Sacramento River flows for fisheries purposes. Minimum instream flow levels in the Sacramento River below Keswick would vary by hydrologic year type (based on the Sacramento River Index) as shown in Table 2-10. River diversion and conveyance facilities associated with this alternative are shown in Figure 2-13.







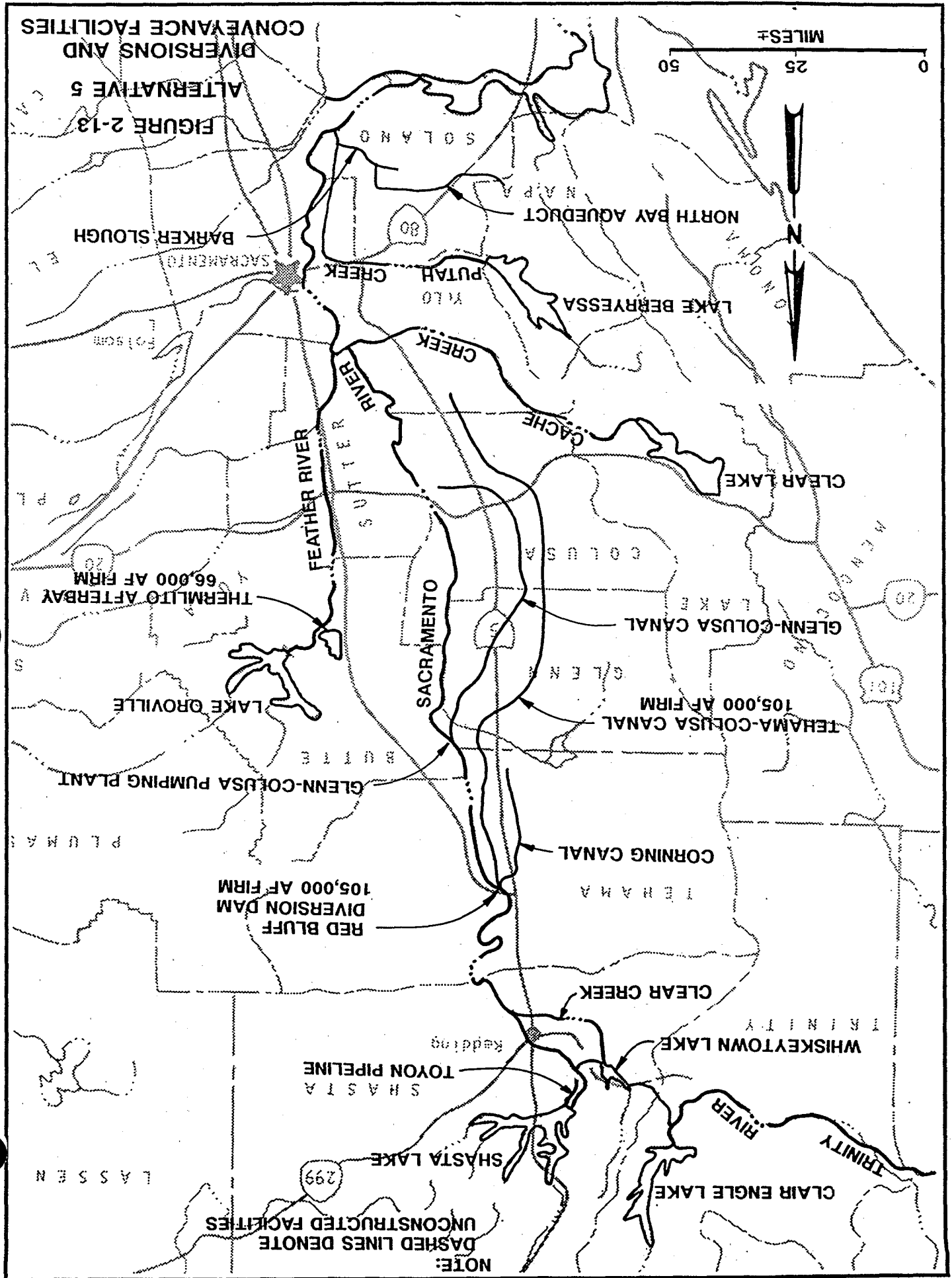


Table 2-10. Minimum Sacramento River Instream Flows
Under Alternative 5

Predicted October 1 Shasta Reservoir Level	Type of Hydrologic Year			
	Wet	Above Normal	Below Normal	Dry
Greater than 2,800,000 af	6,000 cfs	6,000 cfs	6,000 cfs	5,500 cfs
2,300,000- 2,800,000 af	6,000 cfs	5,000 cfs	5,000 cfs	4,500 cfs
Less than 2,300,000 af	6,000 cfs	4,500 cfs	4,500 cfs	4,000 cfs

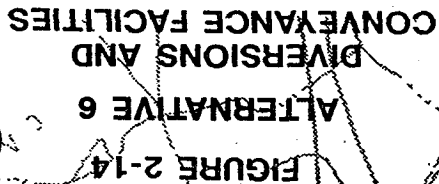
During critical years flows would be reduced to 2,300 cfs from March through September and 2,800 cfs from October through February. Flows during May through August would be determined by releases to meet irrigation needs and would be substantially higher than the minimums shown.

Refuge water would be delivered through the Tehama-Colusa Canal or from the Thermolito Afterbay through exchange agreements with DWR (i.e., water supplied by DWR from the Feather River would be replaced at the Sacramento River-Feather River confluence by releases from Shasta). The Sacramento, Delevan, and Colusa National Wildlife Refuges would be supplied from the Tehama-Colusa Canal with Sutter National Wildlife Refuge and Gray Lodge Wildlife Management Area supplied from Thermolito.

Available intermittent water would be allocated to increase Delta outflow. No water would be allocated to SRSA agricultural or M&I requestors.

Alternative 6 - Refuge Needs, M&I Needs Within Constructed CVP Units, and American River Instream Flow Needs

Alternative 6 gives preference to a variety of uses to allow evaluation of a hybrid alternative. In the SRSA, water would be allocated to agricultural and M&I requestors on the same basis as for Alternative 2, including limitations imposed by capacities of existing conveyance facilities. Water would be allocated to SRSA refuges on a firm basis, equal to Level 2 needs. Alternative 6 diversion points and conveyance facilities would be the same as described for Alternatives 2 and 5 and are shown on Figure 2-14.



Alternative 7 - Recreation Needs

Alternative 7 gives preference to selected recreational needs associated with Shasta, Clair Engle, and Folsom Reservoirs, and the Trinity and lower American Rivers. In the SRSA, water would be allocated first to maintaining Shasta and Clair Engle Reservoirs levels as high as possible given available yield, with available intermittent water allocated to refuge Level 4 needs, as shown in Table 2-9. The refuge diversion points and conveyance facilities would be the same as described for Alternative 5. Trinity County's request for 500 cfs in the Trinity River during July, August, and September would also be met. No water would be allocated to SRSA agricultural or M&I requestors. River diversion and conveyance facilities associated with that alternative are shown in Figure 2-15.

Proposed Action

Reclamation's proposed water contracting action in the SRSA is similar to Alternatives 1B and 2 (Table 2-6). About 15,000 af/yr of firm water, and 160,000 af/yr of intermittent water, would be allocated to Sacramento Valley agricultural uses, 4,800 af/yr of firm water would be allocated to Shasta Dam PUD, and 171,000 af/yr of intermittent water would be allocated to meet refuge Level 4 needs. No CVP water would be allocated for Yolo and Solano County requestors, since no major conveyance facilities exist to deliver CVP water to these requestors.

Major New Conveyance Facilities Required for Alternatives

Major new conveyance facilities that would be required to implement selected alternatives and shown on Figures 2-7 to 2-15 are briefly described in Table 2-11.

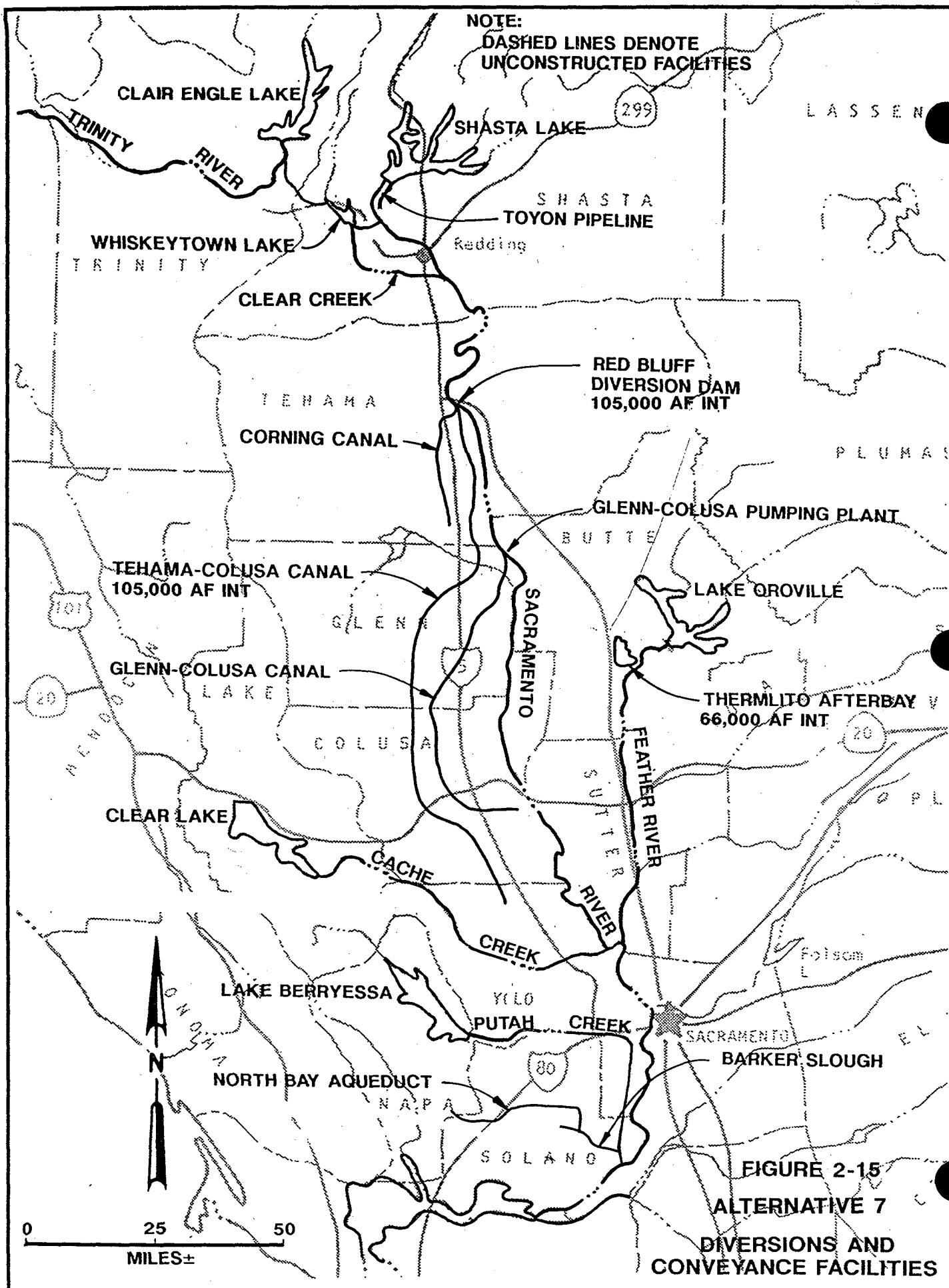


Table 2-11. New Conveyance Facilities Required for Alternatives:
Sacramento River Service Area

Facility Name	Description	Alternatives for Which Facilities Required
Tehama-Colusa Canal extension	<p>The 122-mile Tehama-Colusa Canal extends from its diversion at Red Bluff to its present terminus at Bird Creek, near Zamora. The proposed extension includes a 3.2-mile canal, terminating in the proposed Oat Creek Reservoir. Canal and siphon capacities would be 1,700 cfs. Oat Creek Reservoir could store up to 14,500 af.</p> <p><u>Estimated construction cost (1988):</u> \$20-30 million.</p>	1, 3
Tehama-Colusa Canal offstream storage	<p>Sites Reservoir would be an offstream storage facility along the Tehama-Colusa Canal. It was proposed as part of the West Sacramento Valley Canal Unit. The offstream pumped storage reservoir would be contained by two dams across Funks Creek and Stone Corral Creek in Colusa County. The reservoir could store up to 1,800,000 af.</p> <p><u>Estimated construction cost (1988):</u> \$160-180 million.</p>	1, 3
Yolo-Solano Conveyance System	<p>The Yolo-Solano Conveyance System would be used jointly by agricultural irrigators in Yolo County and M&I users in Yolo and Solano Counties. The facility intake would be located at the proposed Oat Creek Reservoir at the terminus of the Tehama-Colusa Canal in northwestern Yolo County. Approximately 41 miles of new pipeline would be required. The pipeline would follow a north-south alignment through Yolo County, approximately midway between State Highway 113 and Interstate 505. It would follow a southwest-northeast alignment through Solano County, terminating at the proposed 3,000-af Noonan Reservoir. Turnouts to existing Yolo County Flood Control and Water Conservation canals would be provided where canals intersect the proposed pipeline.</p> <p><u>Estimated construction cost (1988):</u> \$150-170 million.</p>	1, 3

ACTIONS NEEDED TO IMPLEMENT ALTERNATIVES

Congressional Actions

The following activities are not part of Reclamation's Proposed Action but could require congressional authorization if Reclamation were to later become involved in implementation:

- o planning and funding of well fields and dual systems to support dependable supply contracts on wildlife refuges,
- o federal participation in planning and funding groundwater development or dual systems for agricultural and M&I requestors,
- o federal participation in planning and funding of new regional conveyance facilities, and
- o approval of a 10(h) agreement with DWR.

Permits and Entitlements Required from Other Agencies

State Water Resources Control Board

The SWRCB would need to approve Reclamation's petition for consolidated and expanded place of use to fully implement Alternatives 1, 2, 3, 4, 6, and the Proposed Action (requestors with lands outside the currently authorized place of use are identified in Chapter 4). To implement these alternatives, the SWRCB would also need to approve Reclamation's petition for additional diversions at the Harvey O. Banks Pumping Plant.

PROPOSED CONTRACTING PRINCIPLES

Reclamation will contract for new or additional water supplies in accordance with Reclamation law and policy, as well as applicable federal, state, and local law. Reclamation will publicly announce its intent to contract water prior to execution of each contract. It is anticipated that all new contracts will be subject to several common contracting principles, including those listed below.

1. The contracts will continue to allow Reclamation to adjust delivery quantities to accommodate changes in the available water supply. In its operation of the CVP, Reclamation must make periodic determinations of the water available for delivery to its contractors. These determinations are based on consideration of a number of factors including, but not limited to, the following: past and forecasted precipitation, carryover storage in CVP reservoirs, instream flow requirements (principally the

Trinity, Sacramento, Stanislaus, and American Rivers), Sacramento-San Joaquin Delta consumptive uses, outflow requirements to meet water quality standards, and delivery requests of its contractors.

2. Water made available under the contracting program will encourage conjunctive use of surface water and groundwater supplies in those areas with developable groundwater. The maximum project allocation committed to a contractor will be premised on the contractor's groundwater availability in years of below normal precipitation. Use of surface water supplies during years of above-normal precipitation will allow recharge of the groundwater basin.
3. Interim water will be made available to dependable supply contractors during the early years of the contract term to provide time for the development of a groundwater supply system that will permit full deliveries in the below-normal water years.
4. Water rates will be determined in accordance with the current CVP water rate setting policy. Rates for individual districts will vary depending on the type of service received and the amount of previous repayment of CVP costs.
5. Contracts for water service will include a water use buildup schedule and minimum payments related to the contract maximum. This requirement will encourage reasonable requests for water and will ensure payment of the appropriate share of the project costs by each water user. The amount of water in the buildup schedule must be paid for whether the water is used or not.
6. Reclamation will establish the time period for entering into a water service contract following the Record of Decision for each water contracting EIS. Agencies failing to meet the established time period will lose their priority for receiving CVP water. This water will then be available for use elsewhere in the CVP.
7. In areas of groundwater overdraft, CVP water will not be provided for irrigation of new lands. Reclamation recognizes that irrigation users may still decide to develop additional acreage in overdraft areas with groundwater.
8. In its operation of the CVP, Reclamation will use all reasonable means to guard against a condition of shortage in the quantity of CVP water available to contractors. Nevertheless, if a shortage does occur because of drought or other causes, Reclamation will apportion available water among the water users capable of receiving water from the same CVP facilities in such manner as deemed equitable and physically possible, consistent with existing contracts and CVP authorizations.

SUMMARY COMPARISON OF WATER CONTRACTING ALTERNATIVES AND THEIR IMPACTS

The EIS Summary section provides a summary comparison of the water contracting alternatives and their impacts.

2-56

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